Marine Review

The National Publication Covering the Business of Transportation by Water

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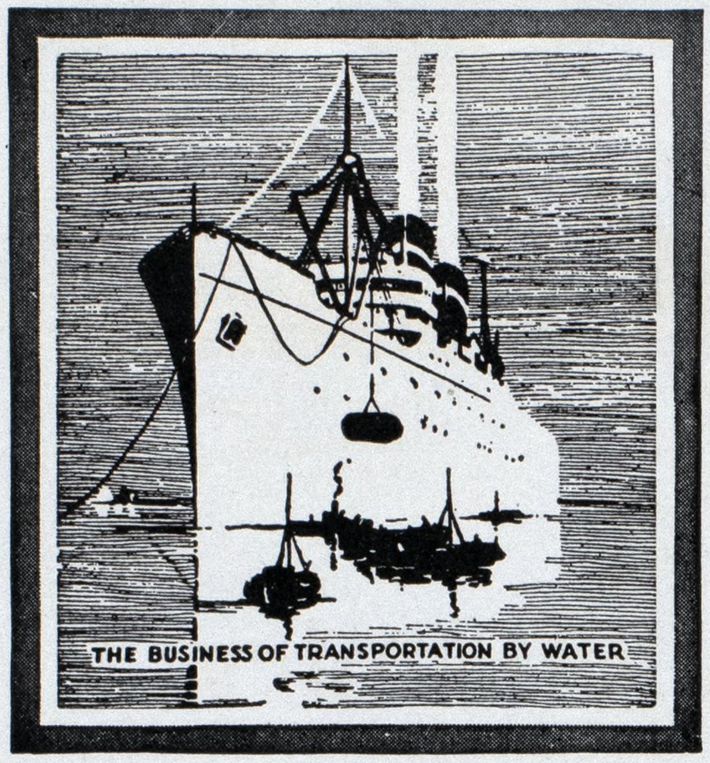

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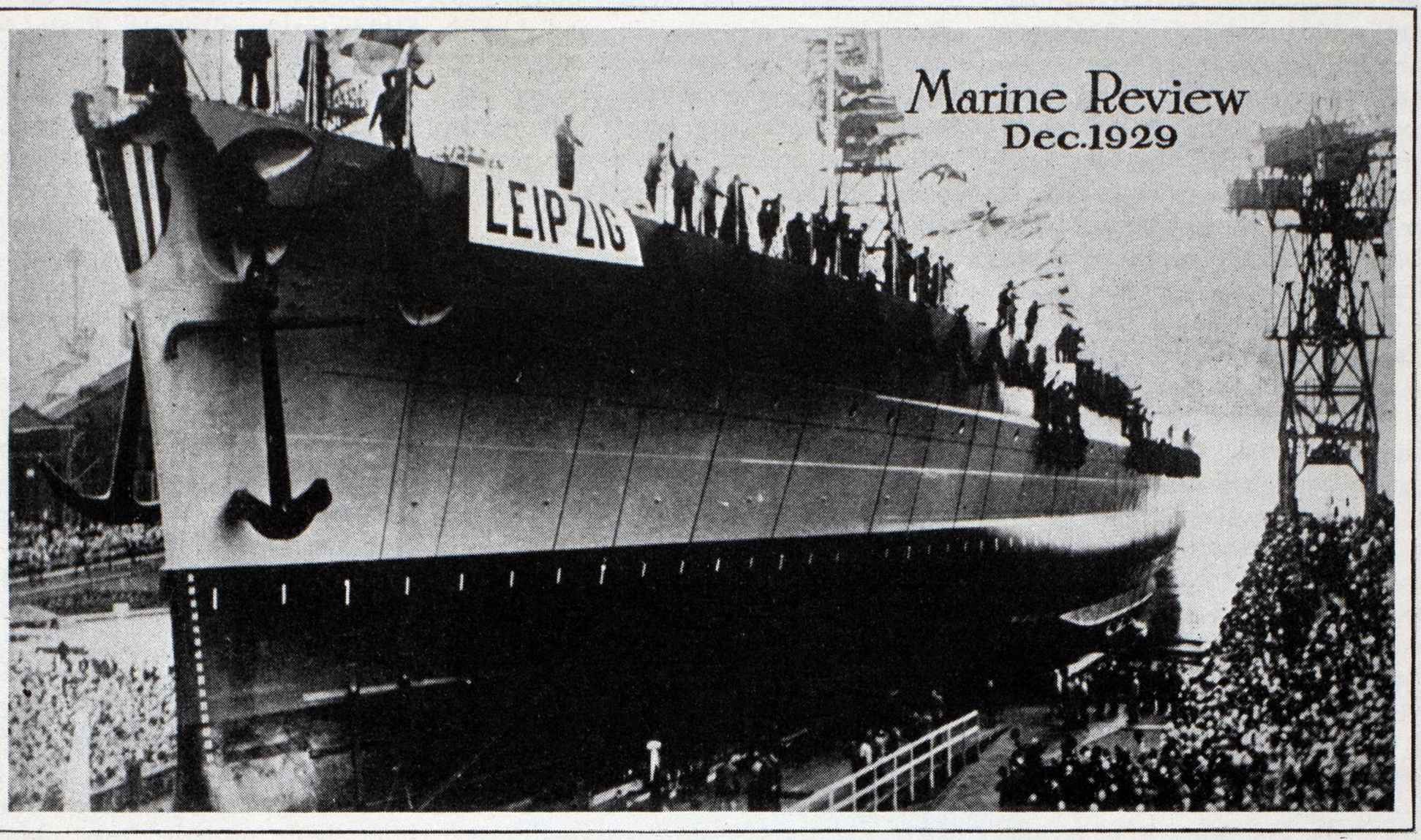


Speedy 10,000-Ton German Cruiser Leipzig Launched at Wilhelmshaven-Fifth New War Vessel Under the Republic

Naval Architects Look Forward to Big Shipbuilding Program

By A. H. Jansson

AT THE thirty-seventh annual meeting of the Society of Naval Architects and Marine Engineers held at New York, Nov. 14 and 15, an air of optimism prevailed concerning present and immediate future prospects for shipbuilding in American shipyards. The president of the society, Homer L. Ferguson, one of the leading shipbuilders and head of the largest shipbuilding plant in the country, in his annual address which we publish in full below, struck the keynote of the new day beginning the long sought for revival of American shipbuilding. In the enactment of the merchant marine act of 1928, known as the Jones-White law, the government, as results already prove, has taken an effective step in the process of building up a privately owned overseas and domestic merchant marine. Though the full effects of this act cannot yet be fully measured, it is clear that it is one of the most important pieces of legislation that has ever been passed in the interests of the merchant marine and of the art of shipbuilding. All of the established shipyards are now well supplied with work and there is every reason to feel that the program for new shipbuilding will continue and will increase over a period of ten years to come.

The president of the society called attention to an unusual number of contracts for vessels awarded during the past year. Among these awards was the one by the United States navy for five cruisers, but unfortunately three of these, which he thought was an undue proportion, were awarded to navy yards. He called attention to the fact that 15 passenger and freight vessels had been contracted for along with several freighters, revenue cutters, ferryboats, carferries and carfloats, besides several hundred barges of various sizes. He also pointed to the increasing interest taken by wealthy Americans in the pleasure of owning and operating large yachts as indicated by contracts for no less than 21 large steel vessels of this type awarded in the past year. In addition to the work already in hand, it was pointed out that there are more than 20 passenger and freight vessels contemplated besides a number of other smaller craft. Also, 20 contracts for tankers have recently

been placed in various yards and orders for additional vessels of this type are anticipated shortly. Very important work in adding to American transatlantic passenger service is in mind and bids, in fact, have been requested on two fine large cabin liners, exceeding in size anything ever before built in American shipyards.

Under these circumstances, it is natural that both the attendance and enthusiasm at the professional meetings of the society should reflect the better feeling which all those engaged in this industry may now have. In the two days' sessions, 14 papers were read and discussed. Later in this article may be found brief abstracts of the papers presented. A large number of new members and associates were elected to the society. The prestige and professional standing of the society has steadily increased since its foundation in 1893. It is now as firmly entrenched in this country as the Institution of Naval Architects is in Great Britain, the society from which it sprang and along the lines of which it is largely patterned. The president of the society, Homer L. Ferguson, was re-elected. Other officers and council members were in the main re-elected with the addition of a few new names. Daniel H. Cox continues as secretary-treasurer and Thomas J. Kain, as assistant secretary-treasurer; its office continues at 29 West Thirty-ninth street, New York City.

On account of its importance to the industry and its excellence as a statement at this time of the present and future prospects for shipbuilding and an American merchant marine, we publish here the presidential address in full.

President's Annual Address

"The history of this society shows many ups and downs. My predecessor, Rear Admiral Taylor, in several of his addresses bemoaned the fact that the shipbuilding industry of the United States presented a very unsatisfactory situation. There have been many lean years. Our yards have been struggling along with such coastwise, lake and river tonnage as has been offered, but it was barely sufficient to keep the proverbial wolf from the door. In fact, several once prosperous yards gave up the struggle and disbanded. We have needed government aid for our merchant marine, such as a number of other countries have had for many years, and now that this is an accomplished fact the outlook for shipbuilding is brighter than it has been for the past decade. As the welfare of this society depends entirely on the condition of our shipbuilding, it should be a matter of keen satisfaction to all of us that we may now expect increased activity and a larger membership, and I will later on have something to say about what this society, as the leading influence in this country in naval architecture and marine engineering, should do to further the interests of shipbuilding.

Government Aid in Shipbuilding

"I referred in my address last year to the favorable loan provisions of the Jones-White act. Since that time we have seen the influence of this act on shipbuilding. The quarter-billion-dollar construction loan fund established by this act has been available for little more than a year, yet the shipping board has granted loans for about one-fifth of the fund to rehabilitate our merchant marine by making possible the construction of modern passenger and cargo vessels in American shipyards for overseas trade. The loans granted so far amount to about $50,000,000, and will furnish three-fourths of the construction cost of eighteen ships. These consist mostly of modern up-to-date fast passenger and freight vessels. When obscurities in the language of the act relative to mail contracts are straightened out we may expect greater activity in the application for loans.

"For the first time since our shipyards were filled to overflowing with the great government shipbuilding program during the war we are able to take an optimistic view of shipbuilding prospects. It is, therefore, very gratifying to be able to record an unusual number of contracts for vessels awarded during the past year. The most important award, perhaps, is the five cruisers for the United States navy, although I am sorry to note that three of these, an undue proportion, have been placed in navy yards. Fifteen passenger and freight vessels have been contracted for along with several freighters, revenue cutters, ferryboats, car ferries and car-floats, besides several hundred barges of various sizes. Americans are turning more and more to the water for pleasure, as is indicated by the contracts for twenty-one large steel yachts awarded in the past year.

"At the present time there are more than twenty passenger and freight vessels contemplated, besides numerous other smaller craft. Very little oil tanker tonnage has been built since the war, due to the large number constructed at that time by the shipping board which have had to be absorbed by the trade, but greater activity has been shown this year. Twenty contracts for tankers, totaling about 200,000 deadweight tons, have already been placed with the various yards, and about 75,000 tons more will probably be placed in the near future.

"The construction program of the United States lines is by far the most important ever contemplated in this country. They have already asked for bids for two 22-knot first cabin ships 705 feet long and propose two more of the same type in addition to two superliners to operate in conjunction with the LEVIATHAN. These larger vessels, it is hoped, will be in service within a very few years and will compete for the North Atlantic passenger trade with the express liners of England, France and Germany. This is a very encouraging outlook, and our shipbuilders should certainly feel that the depression in shipbuilding is over, at least for the time being.

Importance of Merchant Marine

"The naval disarmament conference in 1921 limited the size of new fighting ships for a period of years to 10,000 tons displacement, and the new conference about to convene is likely, among other agreements, to limit the number of naval vessels of this and smaller types. In this connection I wish to call your attention to a fact of vital importance to this society, which is that as the number and size of armed naval vessels is decreased the importance of high-speed merchant shipping is increased. For several years this was apparently given little consideration by this country, as nothing was done by our government to aid our merchant marine until the

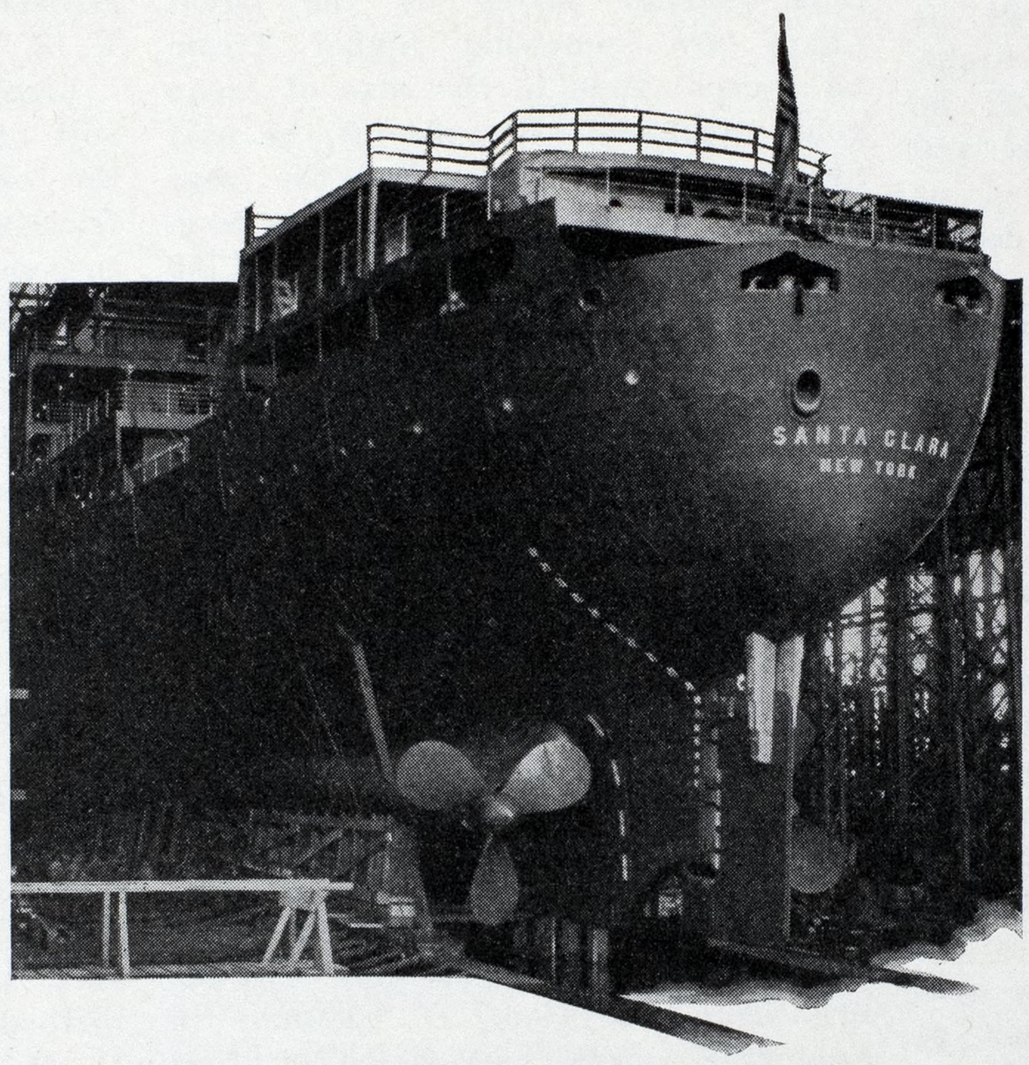
Order New Ships Now

IMPROVEMENT in shipbuilding is already marked. All of the established yards have work in hand for months to come. Now is the time to order new tonnage. The price level cannot go lower. Wages are likely to increase rather than to decline. Material costs are steady and any radical reduction is not to be expected. Economies in ship construction can come only through a larger volume of work and increased efficiency in methods of production. Natural replacements of obsolete tonnage due to a long period of retrenchment will in the aggregate mean much new work in the near future.

enactment of the Jones-White act. Other countries have realized this condition, as is evidenced by the number of high-speed passenger and freight vessels for overseas transportation which they have built. It will probably take many years before we, as a nation, reach a parity in this important respect.

"The most appropriate way of approaching the subject of developments in naval architecture in the past year is to speak of the BREMEN, which startled the world last June by her record-breaking voyage from Cherbourg to Ambrose light ship in 4 days, 17 hours and 42 minutes, with an average speed across the Atlantic of 27.83 knots. Everyone was interested to know how this was accomplished, and immense crowds of people visited the ship in New York, thousands of them out of curiosity, undoubtedly, but many of them technical men who looked over the vessel with critical eyes. The contract for the BREMEN gave the designers and the builders a wide latitude in the design of the hull and machinery. After extensive model tests a fine and special form of hull with carefully designed lines and an apparently small block coefficient was adopted. The dominant feature of the BREMEN'S design of the fore-body is her bulbous bow. This idea is not a new one, as it has been used advantageously for some years in this country to reduce resistance and is now being adopted by European designers. A modified Maier form of lines was adopted for the after-body, where also particular attention apparently has been given to the stern with its very steep bossings. An unusual feature is the aperture in front of the rudder post and the adoption of the peculiar shaped rudder post which fairs in with the Oertz streamline type of rudder.

"The omission of the customary bilge keels has been compensated for by the installation of anti-rolling tanks on the Frahm principle. Wind resistance, which at high speeds amounts to a very substantial amount, has also received consideration, as the forward end of the immense superstructure has been given a streamline shape and the stacks have been made of modified aerofoil shape and are cut off short. Her plating, unlike that generally employed in ship construction, is lapped forward instead of aft below the waterline. Such a practice is said to push the water away from the side of the ship, thus reducing the eddy resistance. There is no doubt that the form of hull and superstructure adopted represents a very considerable saving over the usual form in the horsepower required to attain her speed. The use of high tensile steel throughout has resulted in a considerable saving in weight with a corresponding saving in power. Ship designers and shipbuilders throughout the world will doubtless adopt many of these features in the construction of high-speed passenger vessels in the future.



Turbine Electric Liner Santa Clara for the Grace Line Launched at New York Shipbuilding Co., Camden, N. J., Nov. 14

Developments in Marine Engineering

"In the past year a number of very important problems have been carried further in their development. One of the most important of these, from the owner's standpoint, is the continued improvement in fuel consumption of large ships. In the past year several large passenger ships have gone into service which are operating at fuel oil consumptions which a few years ago were unheard of and would have been considered impossible. This excellent showing is due primarily to the use of higher steam pressures and superheat. In fact, in all large passenger vessels now contemplated with steam machinery it is proposed to use high pressures and superheat so that the total temperature of the steam is close to 700 degrees Fahr., this being about the limit which the present materials in contact with the steam will stand.

"The internal-combustion engine has been extensively used, and improved types are being developed. The electric drive has been tested out further in merchant service and has been found very efficient and reliable. The use of pulverized coal has had quite an impetus, and several new ships constructed especially to use this fuel have been delivered. These vessels operate on considerably lower fuel consumption than hand-fired boilers, but a much greater saving is made due to the use of cheaper grades of coal and the saving in fire-room force. The past year has witnessed trials of our two large airplane carriers, the LEXINGTON and SARATOGA. While these vessels were designed for a speed of 33 knots with 180,000 horsepower, the LEXINGTON made a maximum speed of 1½ knots in excess of this and developed over 200,000 horsepower. I believe we are safe in saying that this is the fastest ship for her size ever constructed by any country in the world. The combination of reciprocating engines and low-pressure turbines has progressed by several installations with a large saving in fuel over reciprocating engines alone. There is considerable activity in the field of watertube boilers of the express type. In the building of high-speed passenger vessels, saving in weight is of the utmost importance and this has led designers and builders of boilers to strive for reduction in weight and higher efficiency.

Safety of Passengers and Ships

"The year 1929 has witnessed important steps in increasing the safety of passengers at sea and of ships and cargo. The international conference on safety of life at sea held in London last April evolved definite rules covering such vitally important subjects as the watertight subdivision of ships, bulkhead and shell openings, fire-resisting bulk-heads, stability, life-saving appliances, fire detection and extinction devices, radiotelegraphy, and safety of navigation. The recommendations of this international conference have not yet been adopted, but I hope they soon will be, as the effect will,

in my opinion, be far reaching and highly desirable. Our government has recently enacted legislation to prevent the overloading of vessels along the lines of that in effect for many years in several foreign countries. However, the technical features associated therewith to define the minimum permissible freeboard remain to be settled. It would be highly desirable to have an international agreement on this important subject, and steps should be taken in this direction.

Society Can Aid Shipbuilding

"This society should sponsor a new model tank at one of our leading colleges in which naval architecture is taught. At present there are only two model tanks in this country, one of which is used primarily in the development of ideas relative to naval construction. We need an additional tank where research work will be undertaken and ideas in naval architecture for merchant ships will be studied and developed. England and Germany are very far ahead of us in their knowledge of actual design of hulls, and this is due to their having many more model tanks in which research and development are being carried on continually. I believe that this society could raise the money by solicitation from its members, from ship operating companies and from shipyards to construct and endow this tank.

"This society should also, I believe, establish a scholarship from the endowment fund for the study of advanced naval architecture at one of our leading colleges (preferably one with a model tank). Subjects for investigation might be suggested by the society and the results made the subjects of papers for presentation at our regular meetings. It is only by continual study and investigation that we can keep up with other nations in this important field.

"In this connection, it is very pleasing to note that the shipping board realizes the value of research and has received an appropriation from congress for half a million dollars for this purpose. I am sure this money will be spent wisely and we may expect some interesting results."

Technical Papers Presented

Fourteen papers were presented during the two days' meeting of the society, Nov. 14 and 15. In accordance with usual custom all of these papers and the written and verbal discussion will be published in full in volume 37 of the transactions of the society which will be ready early in the summer, next year. The titles and names of the authors of these papers and brief abstracts follow:

1. *The Inertia of the Water Surrounding a Vibrating Ship*, by Prof. Frank M. Lewis, council member.

His general conclusions are that the flat bottom amidships is of the greatest importance and that due to this the greater part of the added mass is amidships with the result that the ratio of amplitude at ends over amplitude amidships is much greater than would otherwise obtain. Water inertia is nearly independent of draft so that the natural frequency would vary only slowly with the displacement, and it will not vary as the square route of the displacement for different displacements of the same ship.

2. *Great Lakes Bulk Freighters*, by William Bennett, member.

He gives a brief description of the Great Lakes and the Welland canal. He points out that statistics show that steamer losses on the Great Lakes are somewhat higher (from all causes) than in the case of ocean going steamers. Records for the past fifteen years indicate that the year 1927 was the worst, there having been lost in that year 13 vessels of 26,750 gross registered tons of which 46 per cent were lost due to stranding, 38 per cent due to fire, and 16 per cent due to foundering. Since vessels on the Great Lakes are within easier reach of land than ocean going steamers, the higher percentage of losses, both in ships and human lives, must be accounted for by the fact that storms come up very quickly, giving navigators little warning of approaching trouble.

Some interesting figures are given in this paper on the cargoes carried, iron ore, coal, grain and stone, being the principal items. Single cargoes are large, the CARL D. BRADLEY in September, 1928, carried 16,100 tons of limestone from Calcite to Buffington, Ind. Generally speaking there are five principal types of vessels operating on the Great Lakes, bulk freighters, self-unloading bulk freighters package freighters, canal steamers and oil tankers. An interesting table is given, with the principal dimension and gross tonnage of the ten largest vessels on the Great Lakes. The Canadian vessel, LEMOYNE built in 1926 of 10,480 gross registered tons is the largest in tonnage. Next is the American vessel. HARRY COULBY of 10,180 gross registered tons, built in 1927.

A number of interesting actual cross sections and general arrangement plans as well as photographs are used for illustrations. The author has gone extensively into the calculations for stresses due to various loadings and with assumed wave conditions. It is pointed out that records of deflection of Great Lakes bulk freighters show that hogging varies from 9 inches to 16½ inches with the temperatures between the sea water and the deck varying from a few degrees up to about 30 degrees Fahr.

In conclusion the author states that the real test of the sufficiency of the strength of the large bulk freighters is that they have withstood for years adverse conditions of loading and weather. From experience therefore, he states, we can safely say that they are fully adequate for the service required of them.

This paper caused considerable discussion. Dr. Sadler, Professor Lindblad, and Hugo Frear, who laid out many of the large ocean ore carriers, all commented with interest on Mr. Bennett's paper.

3. *Frictional Resistance of Ship Models*, by Lieut. W. P. Roop, C. C. U. S. N., visitor.

Lieutenant Roop's paper is the result of a great deal of study of all the existing data with reference to frictional resistance, his idea being to combine in a new formula, if possible, all the good points of the various existing systems. He does give a final formula which he believes has the above qualifications. Some of the comments in the discussion however, indicate that a more certain result may be obtained by sticking to the best known and most widely used of the old standard formulas. This does not however, minimize the value of the work done in the preparation of this paper. It is only by such thorough and intelligent analyses that it will be possible to determine what additional experiments will be necessary to improve on the results of methods in use today. Rear Admiral D. W. Taylor, retired, dean of the small group of Americans versed in the more scientific aspects of naval architecture, commented at length on this paper, bringing out that certain experiments in the aeronautics field confirmed some of the experiments on frictional resistance of water.

4. *Model and Full Size Tests of a Single Screw Merchant Vessel*, by R. R. Adams, visitor.

The paper by Mr. Adams is of especial interest to the naval architect and shipowner who may be contemplating the building of a new ship. He gives in his paper the model results and these are compared directly with actual standardization trials for the completed ship. The model results and trials were on the S. S. CLAIRTON and the latter were arranged by the shipping board. Before standardization trials the vessel was drydocked, the under water body cleaned and painted and a cargo of

coal was loaded. These trials were conducted by the regular navy trial board over the measured mile at Rockland, Me., on July 25, 29 and 31, 1929. The vessel had mean drafts of 24 feet, 20 feet and 16 feet respectively and with drags of 3 feet, 4 feet and 5 feet respectively, the three conditions being identical with the corresponding model basin tests.

The author points out that the trial shaft powers are in excess of those estimated by the model basin to the extent of from 22 to 25 per cent and the revolutions for corresponding speed are from three to four higher. An interesting check can be made as to the wake fraction. The real slip of the vessel on trial may be closely estimated. To determine whether the discrepancy with model basin estimates is with respect to resistance or to propeller performance or both, new trials are planned for the CLAIRTON. A thrust measuring device has been ordered and will be installed in place of the existing thrust block. The propeller blades are to be smoothed by grinding and buffing and the vessel is again to be cleaned and painted. Previous trials will then be repeated. The new results may not be conclusive and may certainly be questioned within limits of 5 per cent but the present discrepancy is so large that its source should not be impossible to locate.

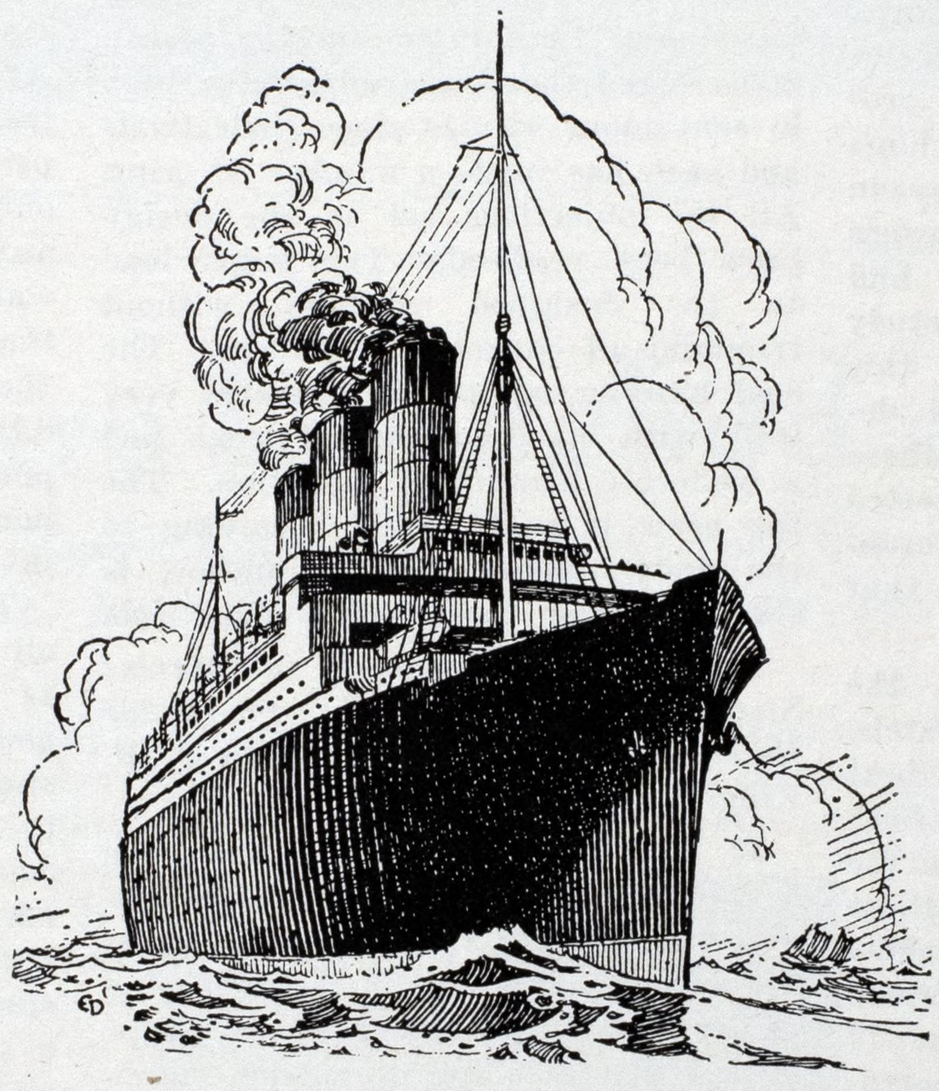
5. *Model Results of a Four Bladed Propeller Series,* by Rear Admiral David W. Taylor, C. C. U. S. N., retired, past president.

This paper is the result of the current research program of the shipping board under direction of Commissioner H. I. Cone. As a part of this program, tests of a series of 24 model propellers were recently completed at the model basin in Washington. The results of these tests are incorporated in this paper for the information of naval architects and marine engineers.

This research applies primarily to propellers of the single screw merchant ship of slow or moderate speed. Models were all four-bladed and nine inches in diameter. The blades were elliptical in outline, the developed blade in each case, being an ellipse tangent to the shaft axis. The hubs were solid and 1.8 inches in diameter. The tests were run according to the usual present methods at the model basin. The centers of the propellers were submerged 11 inches in still water for the experiments conducted.

6. *The International Conference on Safety of Life at Sea,* 1929, *with Special Reference to Ship Construction,* by Rear Admiral George H. Rock, C. C. U. S. N., member.

The purpose and scope of this paper are indicated in the author's foreword. If any conferences is to be successful, those who attend must be thoroughly prepared to discuss the matters on the agenda. This paper presents a brief record of the work on construction which was carried out in preparation for participation by the United States in the international conference on safety of life at sea, which was held in London in 1929. Three general technical committees were organized by the department of commerce, one on ship construction, one on radio telegraphy and one on navigation. The navy department offered the services of a naval constructor and of a civilian naval architect to the chairman of the ship construction committee. The bureau of construction and repair of the navy department also arranged to house this technical staff, which was further augmented by a naval architect from the Council of American shipbuilders and a naval architect loaned by the United States shipping board and for a period, a naval architect loaned by Gibbs Bros., New York. The committee with its technical staff then studied a number of various features, such as flooding curves of existing ships, permeability, typical cargoes, permeability laboratory experiments, permeability tests, flooding machinery spaces, floodable length calculations, stability and criterion of service, factor of sub-division. Some of the results of this work are given in Admiral Rock's paper and is of real value to the naval architect.



7. *The International Conference* of 1929 *and the New Convention for Safety of Life at Sea,* by Rear Admiral John G. Tawresey, C. C. U. S. N., retired, member.

The American delegation received the hearty support of the government and of other interests. The author believes that the application of the new requirements will make necessary a re-study of many problems, but he believes in the ability of naval architects and designers as well as the administrations of different countries to equal and even to exceed the convention requirements without unfair or unprofitable expenditure. It is our part, Admiral Tawresey said, to show that these regulations are practicable and useful, that better sub-divisions can be had without economic disadvantage, and to win other countries to these views which must be made accomplished facts in the future.

8. *Corrosion Resisting Steel and Its Application to Ships,* by Harold E. Saunders, C. C. U. S. N., member.

Commander Saunders points out that the method of retarding corrosion most familiar to ship designers, builders and owners and the one most commonly used by them is hot galvanizing. While galvanizing still remains in high favor for protecting steel plating and other parts made from ferrous metals, it is open to certain objections and is a superficial protection, reliable only as long as the initial coating properly applied can be kept intact in service.

He touches upon the importance of design for the most efficient use of corrosion resisting steel. The point is made that corrosion resisting steel is not free from galvanic action, though these steels exhibit more resistance to such action than do the carbon steels. The corrosion resisting steels must be considered in nearly the same category as the carbon steels when designing machinery containing parts of copper bearing alloys to withstand exposure to salt water.

The commander sets down one interesting rule. Since steel is attacked in the presence of bronze, a little steel in the midst of a large area of bronze is to be avoided, whereas a little copper or bronze in the midst of a large area of steel may

frequently be accepted without trouble.

Anyone concerned with the ever recurring problem on shipboard of choosing material to minimize corrosion will find Commander Saunder's paper of exceptional interest and value.

9. *The Colliers Berwindglen and Berwindvale,* by John E. Burkhardt, member.

It is interesting to note in the introductory paragraph of Mr. Burkhardt's paper that 30 vessels are employed in the coal trade between Hampton Roads and New England and that many of these are bulk freighters adapted to this service; also that the last group of vessels built especially for this service is now about 20 years old. It is apparent to the layman, at least, that there should be a market for some new ships in this field.

At any rate, the author states that the Bethlehem Shipbuilding Corp., about two years ago received inquiries from one of these owners for proposals for new vessels. The only hope of replacing the old tonnage lay in finding the most economical design of vessels, both as to first cost and operation and a very careful study of the special requirements of this service was therefore made and designs drawn up. It was one of these designs with some changes suggested by Theodore E. Ferris, representative for the Berwind-White Co., that was accepted by the owner.

Mr. Burkhardt's paper shows the general design of the two vessels. Experiments to determine the best form were carried out with both towed and self-propelled models in the Washington tank. Results of these model tests are given. For the model fitted with the ordinary stern frame the results indicate a difference of 17 per cent, in favor of the contra-propeller at 10 knots. The contra-propeller was therefore decided upon. One of these vessels, the BERWINDGLEN it is interesting to note it fitted with scotch boilers and a Hooven, Owens, Rentschler reciprocating steam engine, while the BERWINDVALE is fitted with Bethlehem impulse turbines, Falk reduction gears, and Babcock & Wilcox watertube boilers.

One of the chief features of interest in both vessels is the use of pulverized coal burners and an arrangement of bunkers and fire room space to suit such installation. After careful study of all available information and from the experience gained through the MERCER installation and the shipping board tests at the Philadelphia navy yard, it was decided that the proper system would embody the following features: 1. The unit system should be used rather than the storage system. 2. The coal should be brought to the pulverizer without handling and with the least possible mechanical equipment. 3. Some means must be found for the proper distribution of coal to the several furnaces, especially in the scotch boiler job, as no device previously tried had proved satisfactory. 4. Erosion of the coal carrying fan must be eliminated or greatly reduced to avoid frequent replacement of the fan rotor. The author then goes on to describe the system which embodies these features.

Making certain corrections for an exceptional use of the auxiliary exhaust and for the lower power due to light ships, it is estimated that the coal per indicated horsepower per hour with the vessel loaded and working under normal operating conditions is 1.7 for the reciprocating engine vessel and 1.2 for the turbine vessel. It is stated that both ships have been in continuous service since their trials and each has made a number of trips. All the objectives set in the design have been realized. The ships load to the designed capacity without trimming of cargoes or bunkers. The coal burning equipment operates very well with no handling of coal and a moderate amount of attention. The fire crew in each vessel according to the understanding of the author, is six less than on a hand fired job.

10. *Increased Economy in Marine Steam Machinery with Particular Reference to Marine Boilers,* by J. H. King, member.

It is evident that there has been a considerable advance in steam engineering during recent years and as the author points out, in the beginning of his paper, machinery of this type is now available for propulsion equipment for ships that is highly economical and practical. Some of the advantages are the low first cost, and unlimited availability of fuel, low operating cost, high efficiency, reliability and low upkeep and maintenance cost. Economy is now obtained for new ships by use of higher pressures and temperatures and by improvements in the method of burning fuel and by the use of apparatus to conserve the heat available in the fuel.

The paper is illustrated by a number of charts and diagrams and typical marine boiler layouts.

In conclusion the author states that with the efficiencies obtainable in the best modern steamships, the costs are such as to make possible, highly economical investments. Also, progress in steam machinery assures higher efficiencies for the future than are now obtainable in present ships.

11. *Trial Trip of the U. S. S. Saratoga,* by Lieut. Commander James T. Alexander, U. S. N., visitor.

This paper makes available a great deal of valuable trial data from one of the outstanding marine engineering achievements of the present day in the United States. A comparison indicates the tremendous size of this new navy flyer. The first airplane carrier the LANGLEY, had electric drive machinery of 7100 horsepower with a maximum speed of only 14 knots, while the SARATOGA with over 212,000 horsepower has a speed of nearly 35 knots. The SARATOGA has now been commissioned and her acceptance trials brought to satisfactory completion.

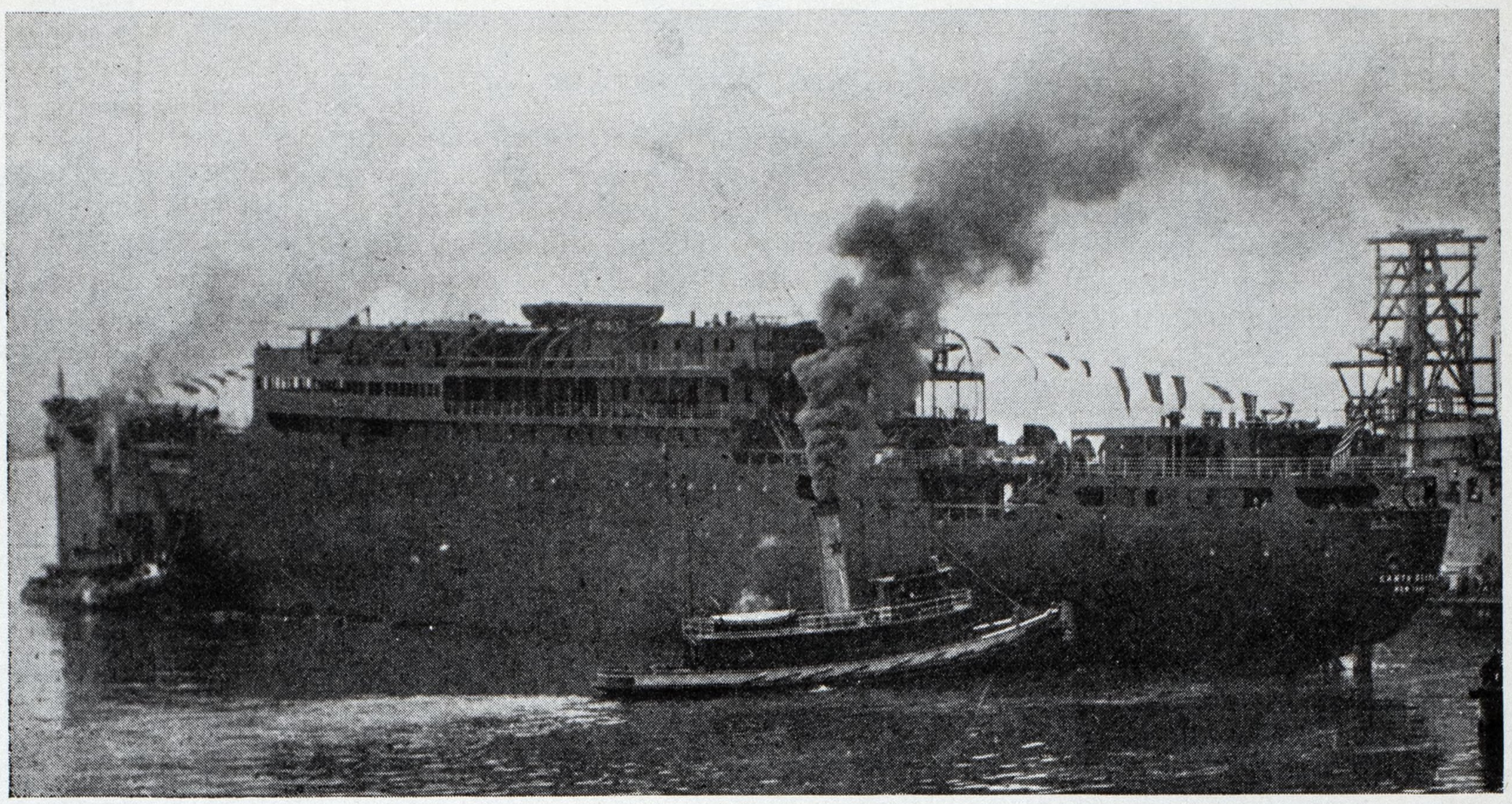
Commander Alexander, in his paper, records interesting specific data from the trial trip of this giant vessel. Water consumption of the turbines at various speeds is given in tables. At 11 knots the water rate is less than 16 pounds per shaft horsepower per hour and this is main condensate only, exclusive of steam used for auxiliaries. At about 32 knots the water rate dropped to slightly less than 10 pounds. At almost 34 knots there is a rise in the water rate of 0.16 pound. Fuel consumption in pounds per shaft horsepower per hour at various speeds is also recorded in a table and chart.

There is a rapid drop in the fuel oil rate in going from approximately 11 knots to 17 knots. From 2.3806 pounds to 1.1870 pounds. At 180,000 shaft horsepower the fuel rate dropped to 0.9497 pound. These values are corrected for fuel oil of 19,500 British thermal units heat contents and for meter calibrations. The fuel consumption in tons per mile reaches a minimum point at about 10 knots which would appear to be the economical speed under trial conditions. Thirty-two standardization runs and the results obtained are given in a table in the paper. The figures indicate excellent uniformity of speed and horsepower on all four shafts.

Finally the author calls attention to the sister ship LEXINGTON'S brilliant performance on the trip from San Diego to Honolulu, a distance of 2228 miles, during which an average speed of 30.7 knots was maintained. This constitutes a remarkable record. Subsequent trial results and the long distance voyage mentioned point to the possibility of both ships steaming continuously at 34 knots or more to the limit of their fuel capacity.

12. *Modern Turbine Propulsion,* by W. E. Thau, member. Printed in full elsewhere in this issue.

(*Continued on Page* 58)



Turbine Electric Liner Santa Clara for Grace Line, Launched at New York Shipbuilding Co., Camden, N. J., Nov. 14

Santa Clara Launched at Camden

Fast Turbine Electric Liner for New York-West Coast South America —First Under Jones-White Law Exclusively for Foreign Trade

THE 16,000-ton turbine electric Grace liner SANTA CLARA was launched at the yard of the New York Shipbuilding Co., Camden, N. J., Nov. 14. The SANTA CLARA is the first passenger ship contracted for exclusively for foreign trade under the merchant marine act of 1928. She will be placed in the Grace line's express service, New York to Peru and Chile, via the Panama canal.

Construction will be rapidly completed and the liner is scheduled to be delivered to the owner next spring. When completed the SANTA CLARA will be the fifth new passenger liner placed in service since 1927. Others are the SANTA MARIA, SANTA BARBARA, SANTA INEZ and SANTA RITA.

Sponsored by Miss Nora Grace, daughter of Joseph P. Grace, chairman of the board of W. R. Grace & Co., the SANTA CLARA slid down the ways without incident, it being a perfect launching witnessed by a large party of Grace line officials and guests. Making the trip from New York on a special train, the officials and their party were welcomed by officers of the New York Shipbuilding Co., headed by Clinton L. Bardo, president of the shipbuilding organization, the train going direct to the yards for the launching ceremony.

The Sponsor—Miss Nora Grace

Following a brief inspection of the great yards under the guidance of Mr. Bardo, the party went direct to the sponsor's stand for the launching. As the SANTA CLARA quivered for the slide down the ways on schedule time, Miss Grace shattered against the prow the wicker-covered bottle, according to the time-honored custom. Gracefully taking the waters of the Delaware river, the SANTA CLARA was greeted with wild cheering from the hundreds gathered for the event and the din of whistles from craft in the harbor.

Slightly faster than the motorships SANTA MARIA and SANTA BARBARA, the new Grace liner will easily develop 18 knots and a maximum of 19 knots. She is 504 feet, 8 inches long, 64 feet beam, 37 feet, 5 inches deep from upper deck to keel, with a displacement of 16,000 tons.

Luxuriously furnished staterooms will provide accommodations for 170 first class passengers. All staterooms are outside rooms. The ship's large cargo holds will have a capacity of 6900 tons. Staterooms were especially designed for passage through tropical latitudes and for comfort and

privacy of passengers. There are numerous private baths and suites de luxe, also a number of single rooms with shower bath and toilet. Designed for the West coast South American trade, the SANTA CLARA, will be a 100 per cent electric powered American liner, built in an American yard, flying the flag of the United States and powered entirely by American machinery. Regarded as a product of the constantly growing trade and passenger traffic between the United States and the South American West coast, via the Panama canal, the SANTA CLARA with the SANTA BARBARA and SANTA MARIA, a trio of new and modern liners, will add great prestige to the American merchant marine, according to Grace line officials. Differing chiefly in interior decoration, color scheme and furnishings, the new queen of the Grace line will have public rooms very similar to these of her sisterships in size and arrangement. The entire electrification of the vessel was accomplished with General Electric equipment. Two screws are used, each being driven by a synchronous induction motor rated at 6300 propeller shaft horsepower. Two 4800-kilowatt, 3-phase, 3000-volt, alternating current generators, each driven by a 3000-revolutions per minute steam turbine, provides power for the motors. Six Babcock & Wilcox, oil fired, watertube boiler furnish steam. The propulsion machinery is controlled by electric equipment located on a convenient platform which controls the speed and reversing of each motor. The propulsion motors are used as strict induction type machines when reversing, the usual practice. Under all running conditions the motors will be strictly synchonous machines. The apparatus is designed to give successful manuervering features under all conditions of operation and in addition, will give the highest economical efficiencies when under way. The engine room is equipped with electrically - operated auxiliaries, and also contains the main switchboard for all the electric circuits. In addition to this switchboard there are a number of smaller local lighting panels in various parts of the ship. Practically all of the auxiliaries on the vessel are electrically operated, including capstans, steering gear, winches, hull ventilating equipment, forced draft blowers for the boilers, circulating pumps, condensate pumps, sanitary pumps and other smaller devices. This involves an aggregate of approximately 950 horsepower in electric motors. Power for these auxiliaries is supplied by four 350-kilowatt, 240-volt turbine generators, the turbines being driven by steam from the same boilers which supply steam for the main propulsion turbines. These auxiliary turbines also furnish power for lighting the ship, a 3-wire 115/230-volt system being used. In normal operation, the ship requires the use of five of its six boilers, uses all of its main propulsion equipment and two of its four auxiliary generating plants. While in port one boiler will supply steam to a single auxiliary generating plant, which will furnish power for lights and auxiliary motors. The ship is enabled to make long cruises at reduced speed at which time only one main propul-

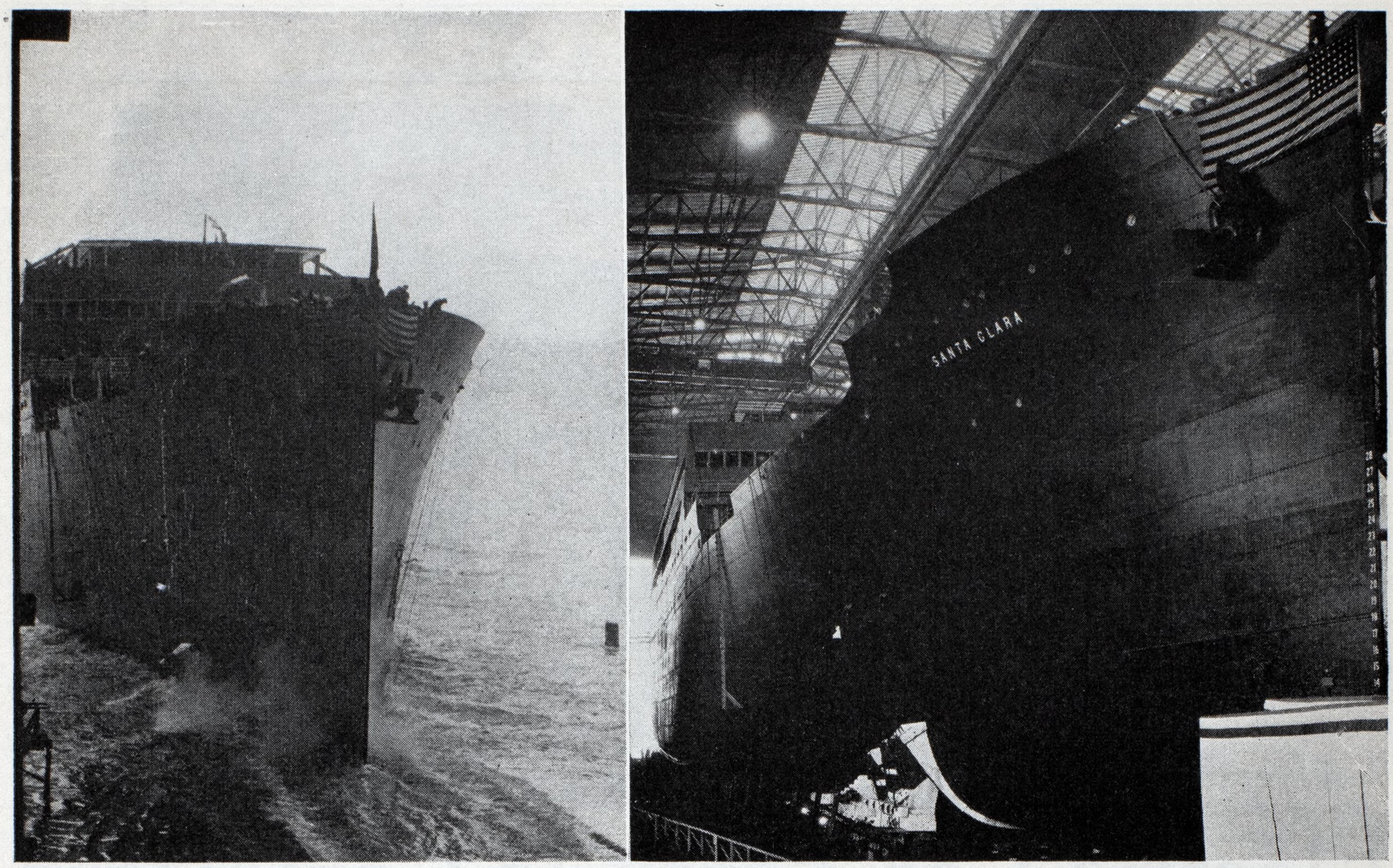
Some Facts About the Grace Company

THE Grace trading and shipping business was founded by William R. Grace almost eighty years ago. For years his organization operated clipper ships around Cape Horn to Chile and Peru. The early exchange of commodities between this country and South America was started by these sailing vessels, which in their world voyages picked up bulk cargoes and gradually found a trade in miscellaneous return cargoes from the United States. Later, steamers were operated via the Straits of Magellan, and finally a direct passenger and freight service was established by way of the Panama canal from the date of its opening in 1914.

FROM the beginning this company has realized that rapid and adequate transportation is the first element in trade development. Their fidelity to foreign commerce has been exceptional, and today the Grace shipping enterprise has developed into seven distinct passenger and freight lines, including the Panama Mail Steamship Co. and the New Orleans and South American Steamship Co. These lines link the Atlantic Gulf and Pacific coasts of the United States with the West coast of Central and South America.

THANKS to such pioneers the ideas of our country are now understood and are popular all over South America. They have helped greatly to bring about closer relations and friendship between the two continents. This ship SANTA CLARA, *representing advances in speed and engineering, will invite North Americans to see South America and will accommodate her share of the large number of South Americans coming to the United States on business or pleasure. She will, we hope, be one of the most important links in the chain of good-will which holds the Americas together.*

At Launching of the Turbine Electric Liner Santa Clara, New York Shipbuilding Co., Camden, N. J., Nov. 14. Left to Right—Joseph P. Grace; Miss Nora Grace, the sponsor; D. Stewart Iglehart; Gale H. Carter; Clinton L. Bardo; and Maurice Bouvier



Launching of the Turbine Electric liner Santa Clara. Left—Just before being water borne. Right—Ready for launching, showing fore poppets which seem to be located well back from bow

sion unit will be needed to drive the two propulsion motors. At any time in regular service, any one generating unit or propulsion motor may be shut down, allowing the ship to proceed under the power provided by the remaining equipment.

Auxiliary equipment includes devices for the safety, comfort and convenience of passengers and crew, deck cargo handling gear, boat handling equipment and warping winches. Motor driven brine circulating pumps, supply refrigeration to 9000 cubic feet of cool air space and 6000 cubic feet of frozen cargo space.

The SANTA CLARA is equipped with the modern devices for safety at sea, including the latest Sperry navigation devices, such as the gyropilot bearing repeaters and automatic steering control of the two-unit type. She also carries two Sperry searchlights.

Joseph P. Grace, chairman of the Grace Line board, speaking before launching guests, said: "The SANTA CLARA adds another fast ship to the regular Grace line passenger service to the west coast of South America. The addition of this splendid boat has been made possible by the Jones-White merchant marine law passed by congress last year. We thank the post office department whose mail she will carry and the United States shipping board for their action under that law. We thank the builders for turning out the fastest and most modern ship that has ever been built in this country for foreign trade. Her entry into our South American service is an important step in the progress of Pan-American trade."

C. L. Bardo, president of the New York Shipbuilding Co., followed with a few words and Representative Arthur M. Free, of California, a ranking member of the merchant marine and fisheries committee of the house of representatives, who was a guest, made an address in which he said in part:

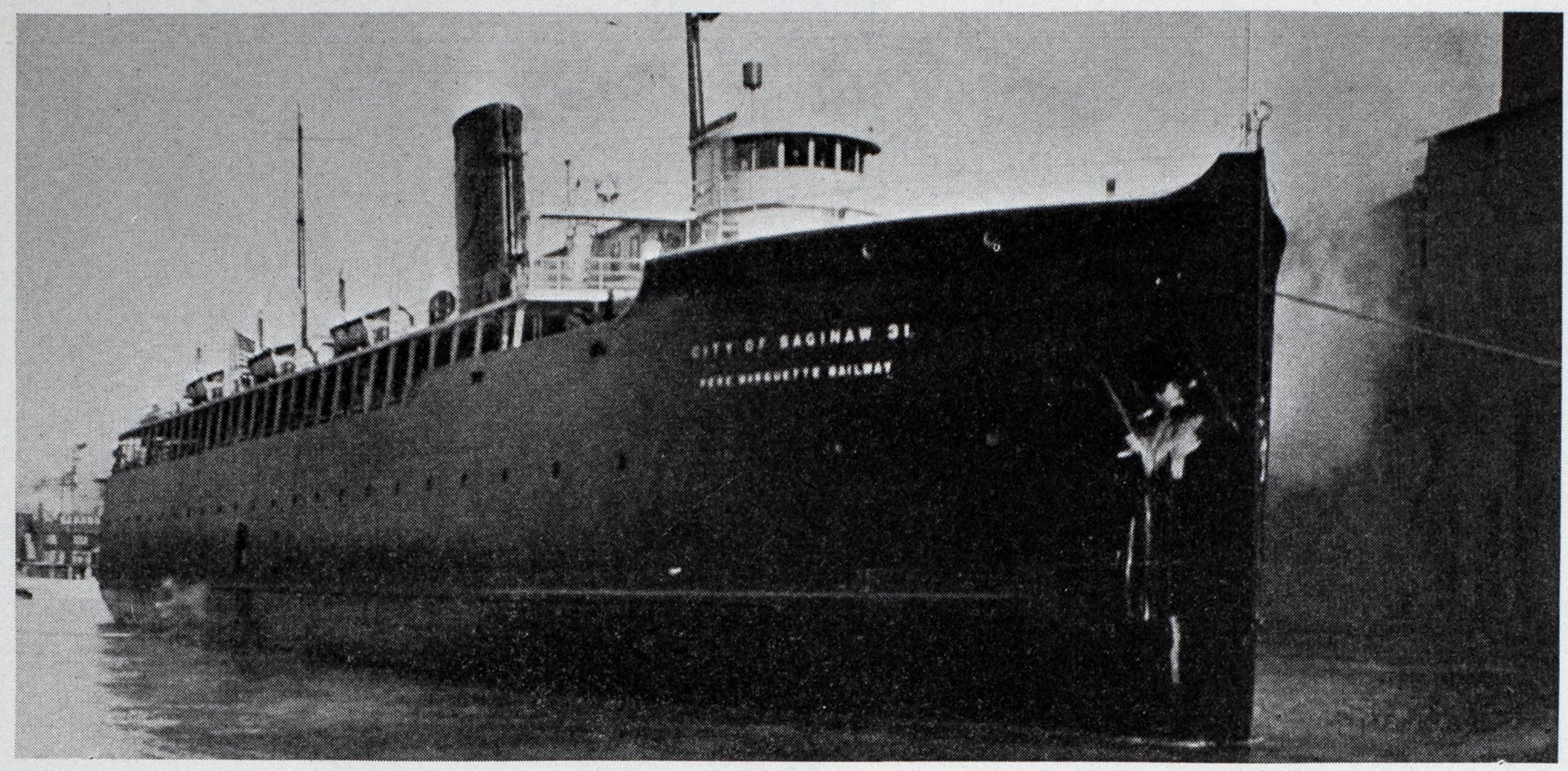
"I take great pleasure in attending the launching of this fine vessel because I am a member of the committee which planned the bill that made this launching possible. The bill provided that the government would loan to the ship owners three quarters of the value of the ships to be constructed and also provided that on well defined routes mail contracts would be made with the steamship lines to carry the United States mail. This is one of the first ships to be launched under that program and I am happy to speed it on its way because of the great trade opportunities for the United States in the South American countries.

"Another feature which makes the launching of the SANTA CLARA important to me is the coincidence that she bears the name of my home county in California, which also happens to be the one in which President Hoover resides as well as the Secretary of the Interior, Dr. Ray Lyman Wilbur."

Board Sells Two Steamers

Sale of the steamer EASTERN BREEZE to Dr. Clarence B. Schultz, an American citizen residing in Germany, for $55,000 cash with the privilege of transferring the vessel to German registry, was authorized by the shipping board on Oct. 23. The contract of sale provides that the vessel shall not be operated to or from any United States port for a period of five years, with the exception of one outbound cargo of coal, grain or scrap iron. Surety bond supporting this covenant in the sum of $25,000 is provided. The vessel is a Japanese-built steel cargo vessel of 6636 deadweight tons, equipped with reciprocating engines and Scotch coal burning boilers and is designed to steam at 9½ knots. She has been laid up in Norfolk since June 1922.

The steamer WESTERN ALLY was sold to the McCormick Steamship Co. of San Francisco for $171,100 on Oct. 30. Sale was made as the result of competitive bidding following advertisements published. The WESTERN ALLY is of 8514 deadweight tons equipped with a triple expansion engine and Scotch coal burning boilers.

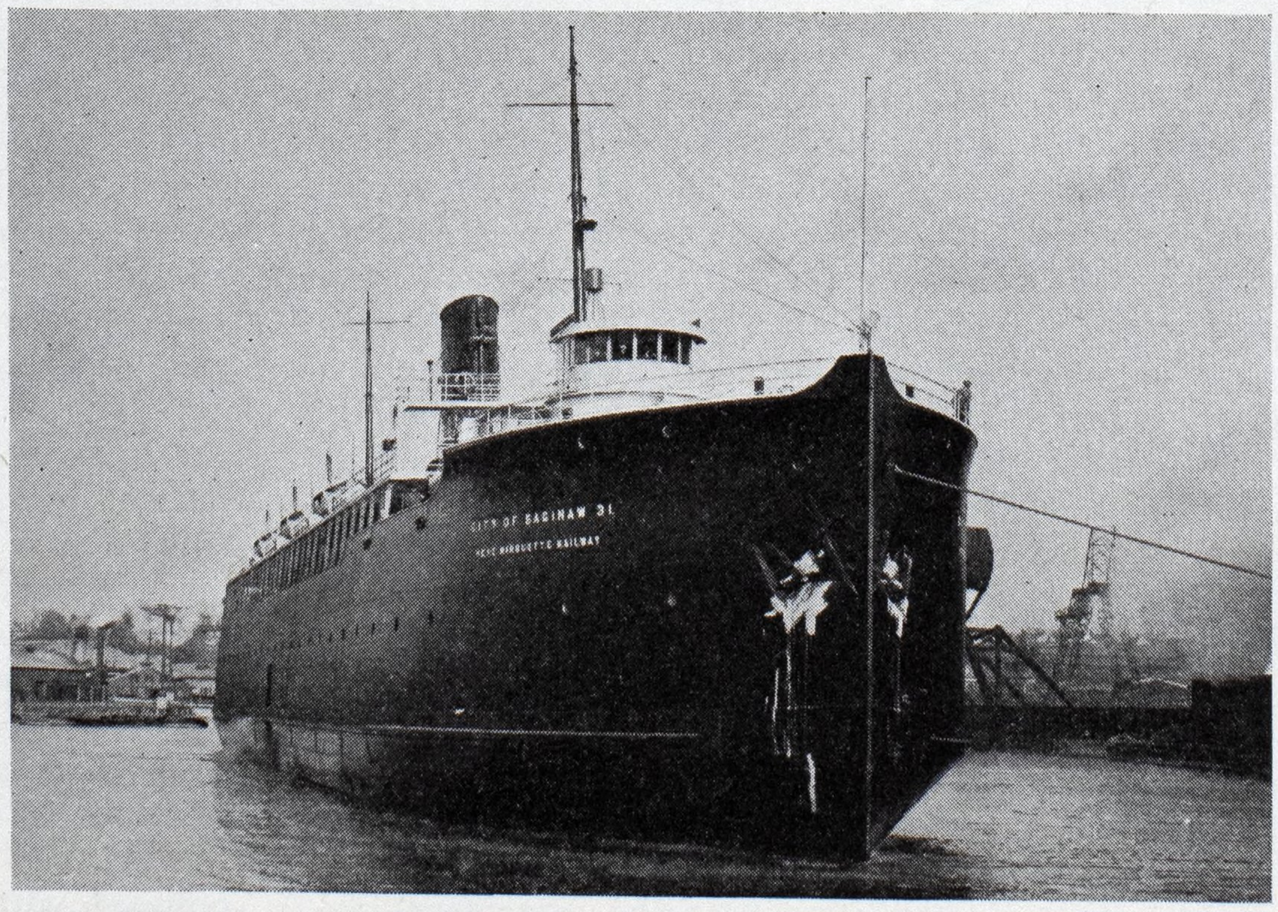


Twin Screw Turbine Electric Carferry City of Saginaw 31 Ready for Trials on Lake Michigan, Nov. 22

Electric Car Ferry Is Completed

City of Saginaw 31 First of Her Type with Turbine Electric Drive — Enters Service on Lake Michigan — Fast and Economical

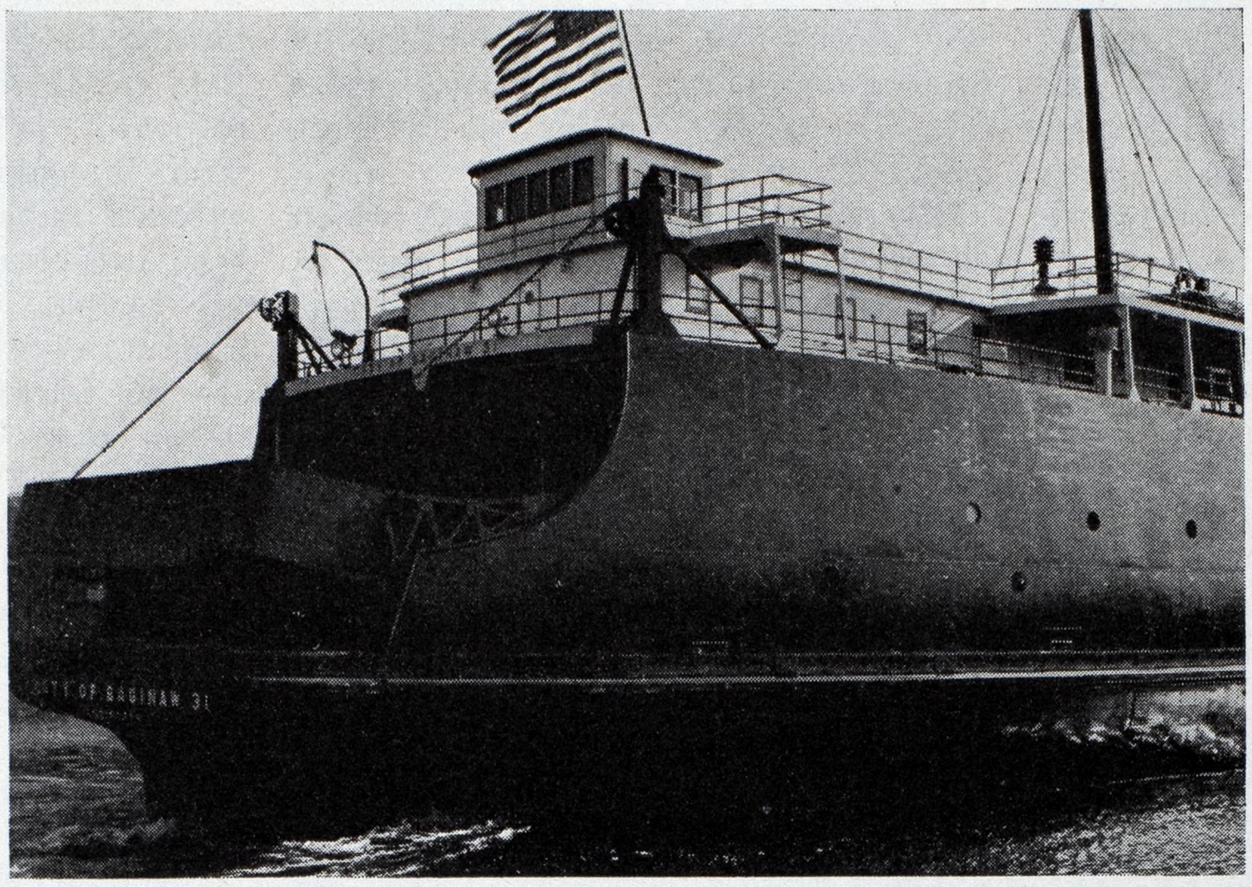
PROGRESS in marine engineering can come only through the vision and courage of the operator in co-operation with the builder of the ship and machinery. In the building of the carferry CITY OF SAGINAW 31 now completed and the sister ferry, CITY OF FLINT 32, nearly ready for launching, there has been a singularly fortunate combination of the two. Credit is therefore justly due to the responsible representatives of the Pere Marquette railway, W. L. Mercereau, superintendent of steamships and his assistant L. H. Kent, chief engineer of steamships, for the initiative and courage they have shown in adopting a radical innovation in the type and amount of power with a corresponding hitherto unheard of speed, for the new carferries needed to meet the demands of traffic. When it was found that additional tonnage would be required it might have been the safer, as it certainly would have been the easier way, to have followed closely established custom and duplicated the later vessels of the fleet. Instead of following this line of least resistance a careful study was made to determine, (1) the results in increased car ferrying capacity of an increase in speed of 25 to 30 per cent, and (2) the practicability and cost of obtaining such an increase in speed at the same time increasing somewhat the car carrying capacity of the vessel itself without undue increase in hull dimensions or radical change in construction. This study showed (1) that such an increase in speed would add at least 25 to 30 per cent in car ferrying capacity besides rounding out the schedule possible within the 24 hours and the superior despatch possible would serve as a most convincing reason for obtaining the shippers patronage, (2) that the increased cost would be a little over one-third more than for the slower orthodox type. The actual cost of the two new carferries CITY OF SAGINAW 31 and CITY OF FLINT 32 is said to approximate $1,250,000 each. Having decided on this basis that it would be economically justified to go to greater speed the next question involved practical engineering problems of the suitability of drive proposed under the severe conditions of service particularlly in winter, breaking and operating



Carferry City of Saginaw 31, Built by Manitowoc Shipbuilding Corp. for the Pere Marquette Railway. Speed over 18 miles per hour

through thick ice as well as through fields and windrows of ice. After careful study and analysis and not a little assurance on the part of the machinery builder, turbine electric drive with twin screws was finally decided upon.

Before giving a detailed account of the new carferry it may be of interest to say something about the service and the existing vessels now in operation. The Pere Marquette railway has for some time maintained what is called a four track railroad on Lake Michigan by means of a fleet of seven carferries operating between the road's terminus at Ludington, Mich., and Milwaukee, Manitowoc and Keewaunee on the Wisconsin or western shore of the lake. When the two new turbine electric ferries with a capacity of 30 42-foot cars each and a speed of better than 18 statute miles per hour are placed in service the potential capacity of this four track system across the lake will be increased from 25 to 35 per cent. The schedule of each of the new ferries each day will be from Ludington to Milwaukee; from Milwaukee to Ludington; from Ludington to Manitowoc or Keewaunee; and return to Ludington.

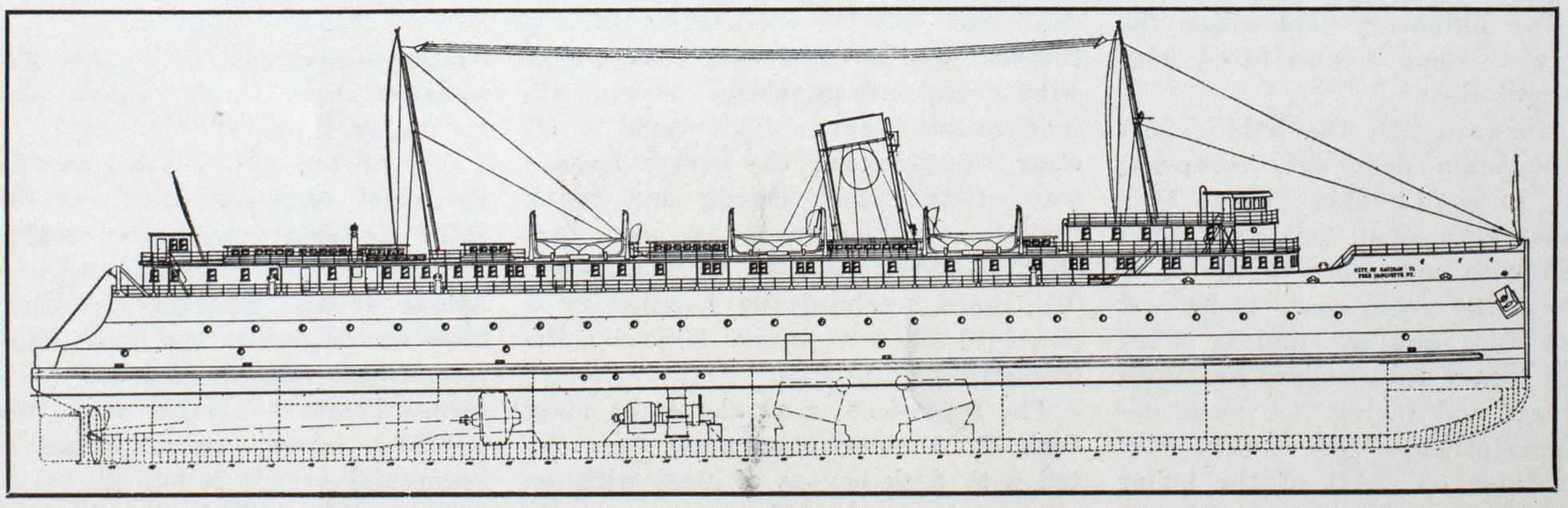


Twin Screw Turbine Electric Carferry City of Saginaw 31. Massive Gate Serves as Protection Against Seas When Lowered in Place

For purposes of comparison it may be interesting to note here certain essential particulars of the newer vessels of the present fleet, the PERE MARQUETTE 21 and 22. These particulars are taken from the April 1925 distinctive ships number of MARINE REVIEW. Both of these vessels were built by the Manitowoc Shipbuilding Corp. No. 21 was completed in the summer of 1924; and No. 22 late in September of the same year. They are sister boats and the general dimensions are: Length overall, 360 feet; length between perpendiculars, 348 feet; breadth molded 56 feet; depth molded, 21 feet 6 inches; draft 16 feet; displacement loaded, 6000 tons; gross tonnage approximately 2990; passenger capacity 24; cargo capacity, 26 railway cars of 100 tons each; speed, 14 statute miles per hour. There are two main engines; triple expansion steam, 20½ x 34 x 56 inches and 36 inches stroke developing 1350 indicated horsepower each. Each engine is direct connected to a propeller. Steam is supplied at 185 pounds pressure per square inch by four scotch boilers with Howden forced draft and hand fired coal as fuel.

The carferry PERE MARQUETTE 21 was, until the advent of the new CITY OF SAGINAW 31, the flagship of the fleet. She is a staunch seaworthy and successful vessel judged on actual performance. On the occasion of the launching of the CITY OF SAGINAW 31 on Aug. 6 while carrying guests to this event she is believed to have established a new crossing record for Lake Michigan. With a full load of cars she crossed from Ludington, Mich. to Manitowoc, Wis., a distance of 65 miles in 3 hours and 46 minutes or at an average speed of 17.25 statute miles per hour. It is said to be the fastest time ever made by any craft up to this time. This is the sort of competition that the CITY OF SAGINAW 31 must meet and overcome. With the completion of the two new carferries (the second of these two the CITY OF FLINT 32 will be completed early next year) the Pere Marquette will have a fleet of nine vessels on Lake Michigan and it is interesting to note in passing that officials of the road are hopeful of seeing the fleet increased to fourteen within the next 10 years. This means five additional vessels after the commissioning of the CITY OF FLINT 32.

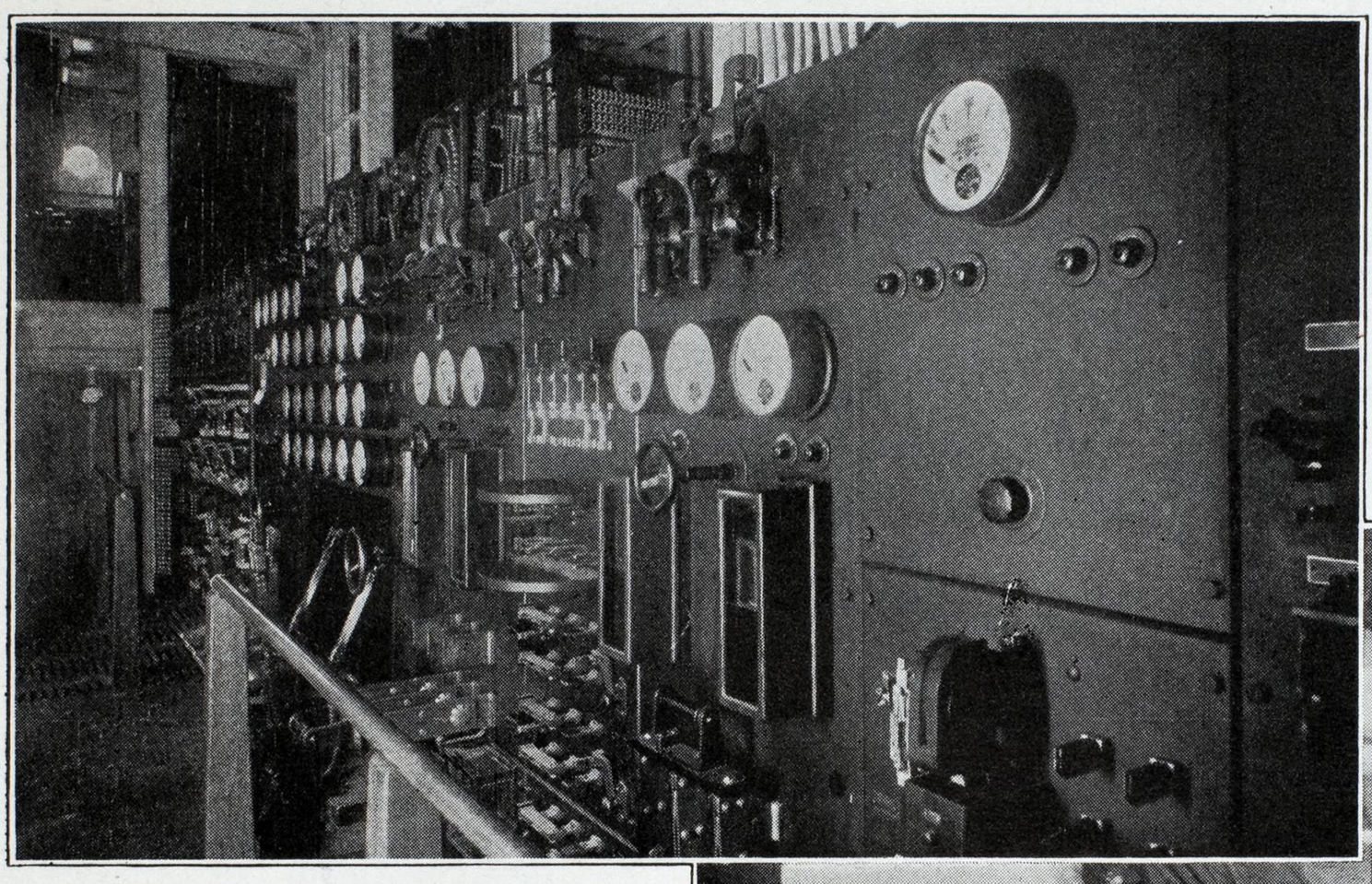
The first sea trail of the CITY OF SAGINAW 31 was held on Lake Michigan off the Wisconsin shore on Nov. 22 at which time the compasses were adjusted. She left the yard of the Manitowoc Shipbuilding Corp., about 10:30 a.m. and returned at 6 p.m. A run of 17 miles north to Keewaunee was made in less than one hour while developing less than full power. The main machinery worked smoothly and with entire satisfaction. Steam was



Outboard Profile of the Large and Fast Turbine Electric Carferry Saginaw 31—Latest Modern Design

supplied by three of the four water-tube boilers, which is the normal operating condition.

The CITY OF SAGINAW 31 and her sister ship, the CITY OF FLINT 32 are substantial steel, single ended, twin screw carferries generally of the usual modern design of vessels for this service. The hull is built on the frame system of construction. The frames are 10-inch 24.3-pound channels and are spaced two feet except forward where the spacing is closer. The flat keel plate is of 32-pound plate, and continues well forward and aft.



MAIN ELECTRICAL CONTROL BOARD OF THE CARFERRY CITY OF SAGINAW 31

The shell, generally, is of 5/8-inch plating which is doubled at the water line. The shell plating forward is also doubled and there is extra stiffening for strengthening against ice damage. There are three steel decks, main deck, spar deck and boat deck. Below the main deck, which is a heavy watertight strength deck, the hull is divided into nine compartments by eight watertight bulkheads. Watertight doors are fitted in the bulkheads between the boiler and turbine rooms and between the latter and the motor room. The bulkhead, separating the steering gear room is also fitted with a watertight door.

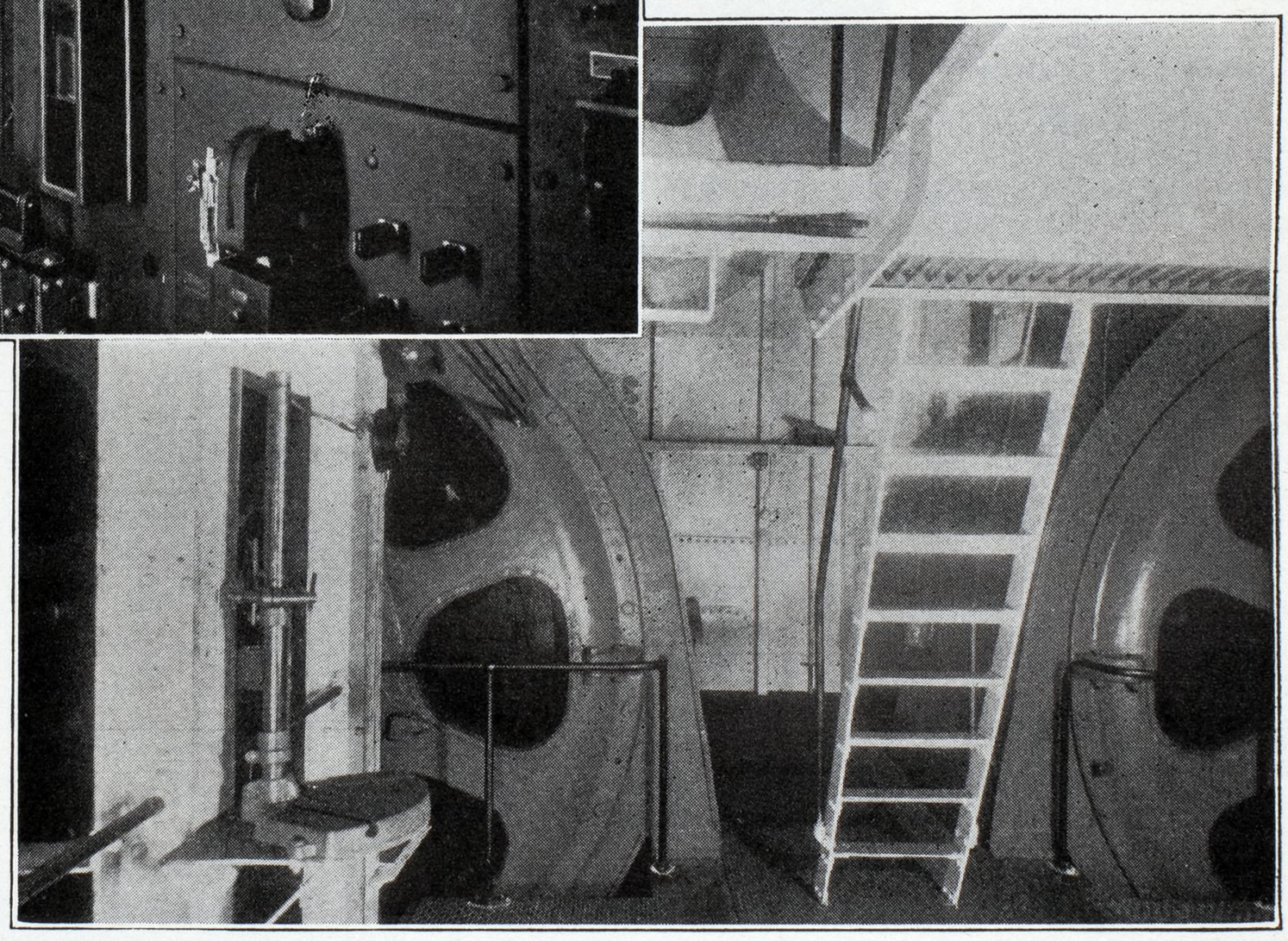
From forward aft, the hold spaces below the main deck are, forepeak; hold No. 1; coal bunker space; then boiler room with small side coal bunkers fitted with conveyors to the stokers. The boiler room space is 64 feet in length fore and aft and is fitted with four water tube boilers arranged two abreast and facing. A more detailed description of the boilers will be given later on. Aft of the boiler space comes the turbine room, 56 feet in length, fore and aft.

Just aft of the turbine room is the motor room, 34 feet in length fore and aft. The two propulsion motors, each direct connected to a propeller are located in this space.

Aft of the motor room on the lower deck level is a space devoted to crews' quarters, extending for a distance of 40 feet fore and aft and for the entire width of the vessel. Accommodations are provided in eight rooms for 16 firemen and oilers. In this space there is also a large toilet for use by these men.

The main deck of the vessel, which is also the strength deck, is open at the rear and is fitted with four tracks with a capacity of thirty, 80-ton, 42-foot railroad cars. This deck is all clear except along the center line in way of the stack casing and trunk casing over the engine room. This deck is closed off aft with a heavy drop gate, mechanically handled by a powerful electric winch built by the shipyard.

The spar deck, next above the main deck, is a substantial steel deck fitted with deck houses of steel with accommodations for the crew and 43 passengers in staterooms. In the extreme forward end of this house is a ladies' and gentlemen's lounge or observation room, port and starboard respectively. The steel deck house has a wide central space carpeted and fitted with comfortable upholstered settees. This is the passenger saloon and social room. The staterooms are on either side. The walls are finished in beautifully grained mahogany in natural finish. Haskellite wood panelling, cut to shape and installed by the shipyard, is used throughout. The trim is painted white. The whole presents an exceptionally tasteful and even luxurious appearance. The funnel casings divide the public space into forward and aft saloons. Aft of the passenger quarters and the saloon, there is a hallway leading out on the spar deck. The passenger dining room and galley are aft of this hallway. The dining room seats 54 at one time. Around the galley are grouped, officers' messroom, crew's messroom, pantry, refrigerator and storeroom. The refrigerator is of Frigidaire automatic type and the



TWO PROPULSION MOTORS ON CARFERRY CITY OF SAGINAW 31—EACH OF 3600 S.H.P. DIRECT CONNECTED TO A PROPELLER. SINGLE ARMATURE, A.C. CURRENT

equipment besides cooling the ice box, includes three water coolers and one ice maker.

Aft of the galley are quarters for the chief engineer, first, second and third assistant engineers; four boys, two cooks, a crew's toilet, crew's lounge room. Quarters for the deck crew are located in the forecastle head, providing accommodations for four men. Forward of this space are the windlass room, paint locker, lamp room and crew's toilet.

On the boat deck there is a texas steel house with comfortable accommodations for the captain; first, sec-

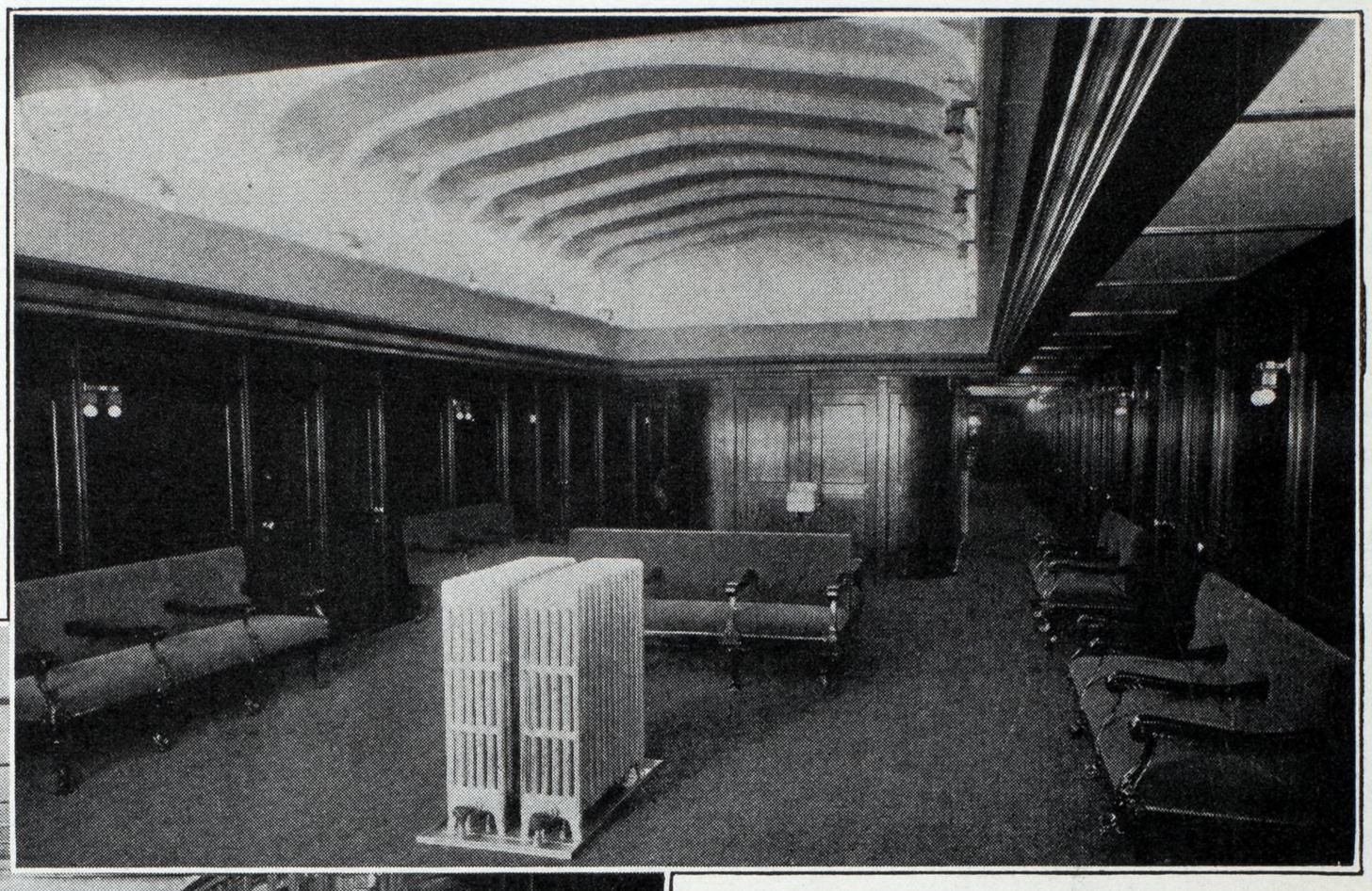
ond and third mates; three wheelsmen; three lookouts; three watchmen and a toilet. On the boat deck, aft of the texas, are three 30-person metallic lifeboats on each side. These six lifeboats were supplied by the Athens Marine Mfg. Co. and are served by Steward davits. Aft of the lifeboats on the boat deck, there is one 30-person life raft on each side. On the after end of the boat deck there is a small pilot house fitted with steering wheel, engine telegraph and compass, so that the ship can be navigated from this point if desired.

The dimensions of the carferry CITY OF SAGINAW 31, are length on keel, 368 feet; length overall, 381 feet 6 inches; molded beam of hull, 57 feet; depth to car deck, 22 feet 6 inches; depth to spar deck, 40 feet 9 inches; gross tons, 3327. The draft in light condition is about 13 feet and is approximately the same forward and aft. The draft fully loaded is 17 feet and will be about 16 feet forward and 18 feet aft. The two propellers are of cast steel, solid and four bladed. They were designed by the Manitowoc Shipbuilding Corp. and they are not machined. The designed speed of the vessel, under working conditions, is at least 18 statute miles per hour. This is about four miles faster than the best of the old ferries.

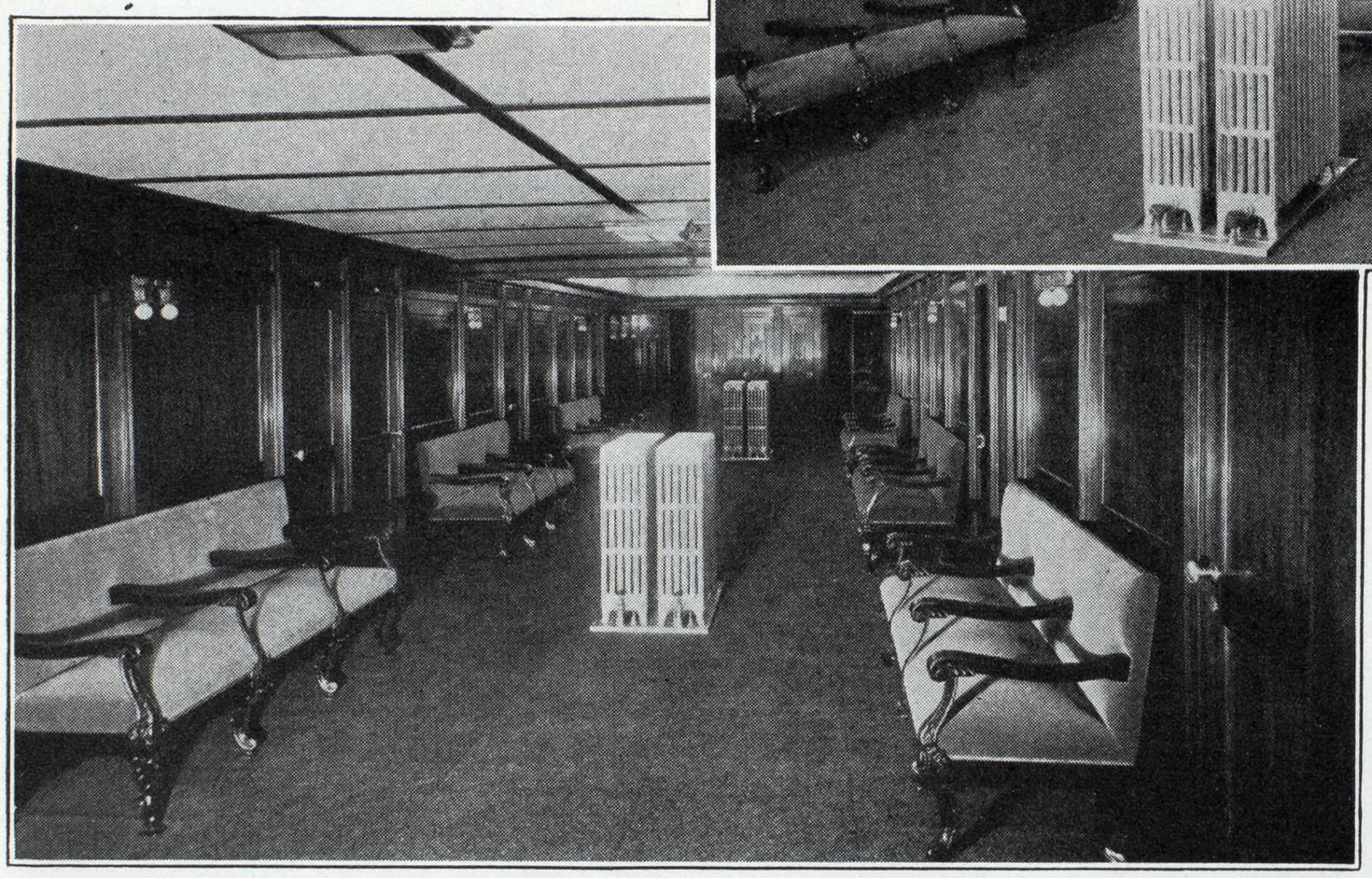
The hull in general is quite similar to previous carferries, but it is larger and will therefore carry a greater load. The latest aids to navigation have been fitted, including Sperry gyro compass and Federal radio compass. There is an excellent telegraphic communication system from the bridge to the engine room. This system was furnished by the Kirk, Habicht Co. The two magnetic compasses, one forward and one aft are of Kelvin-White make. This vessel differs radically in one respect from the existing ferries, in that she has one large stack instead of two small ones.

The steering gear of double tiller type, with duplicate electric drive of two 75 horsepower direct current geared electric motors, built by the Benson Electric Co. is certainly a fine mechanism. It has the appearance of sturdy construction and great precision and care in workmanship. Swivel blocks on screws, moving athwartships, work in and out on the short polished steel tillers. To insure positive operation, the steering gear may be operated from two separate stands in the pilot house. There are two separate control panels in the engine room and as mentioned above the gear itself has dual drive motors. With this setup it is possible to change, at once, from one side to the other in the pilot house. Certainty of maneuvering, which is of utmost importance in the case of these vessels making port as they do several times during each twenty-four hours is a prime necessity. This gear is located on the lower deck at its extreme after end.

On asking Mr. Mercereau what his reasons were for going to turbine electric drive, his answer was brief and to the point, speed and economy. To accomplish these two objectives the turbine electric drive seemed best fitted. The main propelling machinery on the CITY OF SAGINAW 31 built by General Electric Co., consists of two impulse type, fourteen stage, turbine generating sets. Each set is rated at 2880 kilowatts, 2300 volts at 3600 revolutions per minute; three phase, 60 cycle, alternating current. Each generator delivers current to a



PASSENGER LOUNGE CITY OF SAGINAW 31



PASSENGER STATE ROOMS ON EITHER SIDE OF SALOON FINISHED IN BEAUTIFULLY GRAINED MAHOGANY

3600 shaft horsepower, single armature, propelling motor operating at 118 revolutions per minute. Each motor is direct connected to a propeller of a diameter of about 14 feet. A Kingsbury thrust is used.

Speed of the propelling motors is regulated from full to three-quarters by slowing down the turbines. From three-quarters speed to 30 revolutions per minute, the speed is controlled by interposing resistance in the secondary circuit. This is all done from a central control panel located in the after end of the engine room. On this panel are also mounted, before the eyes of the engineer, speed indicators, ammeters, volt meters, meters for temperature of generators and motors, auxiliary power and other data.

The larger part of the auxiliaries aboard are driven by alternating current motors. There is a dual drive auxiliary set consisting of a turbine reduction geared alternating current generator and a direct current generator of 575 horsepower. For port operation this turbine is operated to supply both alternating and direct current. When the ship is under way the alternating current unit of this set operates as a synchronous motor

driving the direct current generator, thus taking advantage of the low steam consumption of the main unit for auxiliary power. At the same time, should the main turbines be down for any cause, this set will continue in operation, driven by its own turbine. There is also a turbine driven, direct current generator of 150-kilowatt capacity for emergency use.

Each of the main generating units exhaust to a 3500-square foot Worthington condenser with motor driven circulating and condensate pumps and air ejectors by the same manufacturer. A matter of interest is the wide use made of centrifugal pumps on this vessel. These pumps were furnished by the Dean-Hill Pump Co. and may be enumerated as follows: One six-stage centrifugal, 60-horsepower, motor driven feed pump; one 30-horsepower, motor driven centrifugal fire pump; one cooler and one sanitary centrifugal pump each motor driven of 15-horsepower; one 7½-horsepower motor driven fresh water pump; and one 3-horsepower motor driven drinking water pump. So much for the electric motor driven pumps. There is also a 12-inch centrifugal ballast pump by the same manufacturer but direct driven by an Engberg vertical steam engine. Also, one auxiliary feed pump, horizontal duplex, 8 x 12 x 14 inches; and one horizontal duplex bilge pump, 8 x 10 x 12 inches both steam, and supplied by Dean Bros.

The feed water heating is done in two stages, using steam extracted from the main turbines. For this purpose a low pressure heater of the Griscom-Russel type and a high pressure heater of Reilly type are used, the feed water passing through the low pressure first. The final temperature of the feed water is 238 degrees Fahr. Lubricating oil for the main turbine is purified by passing through a De Laval centrifuge.

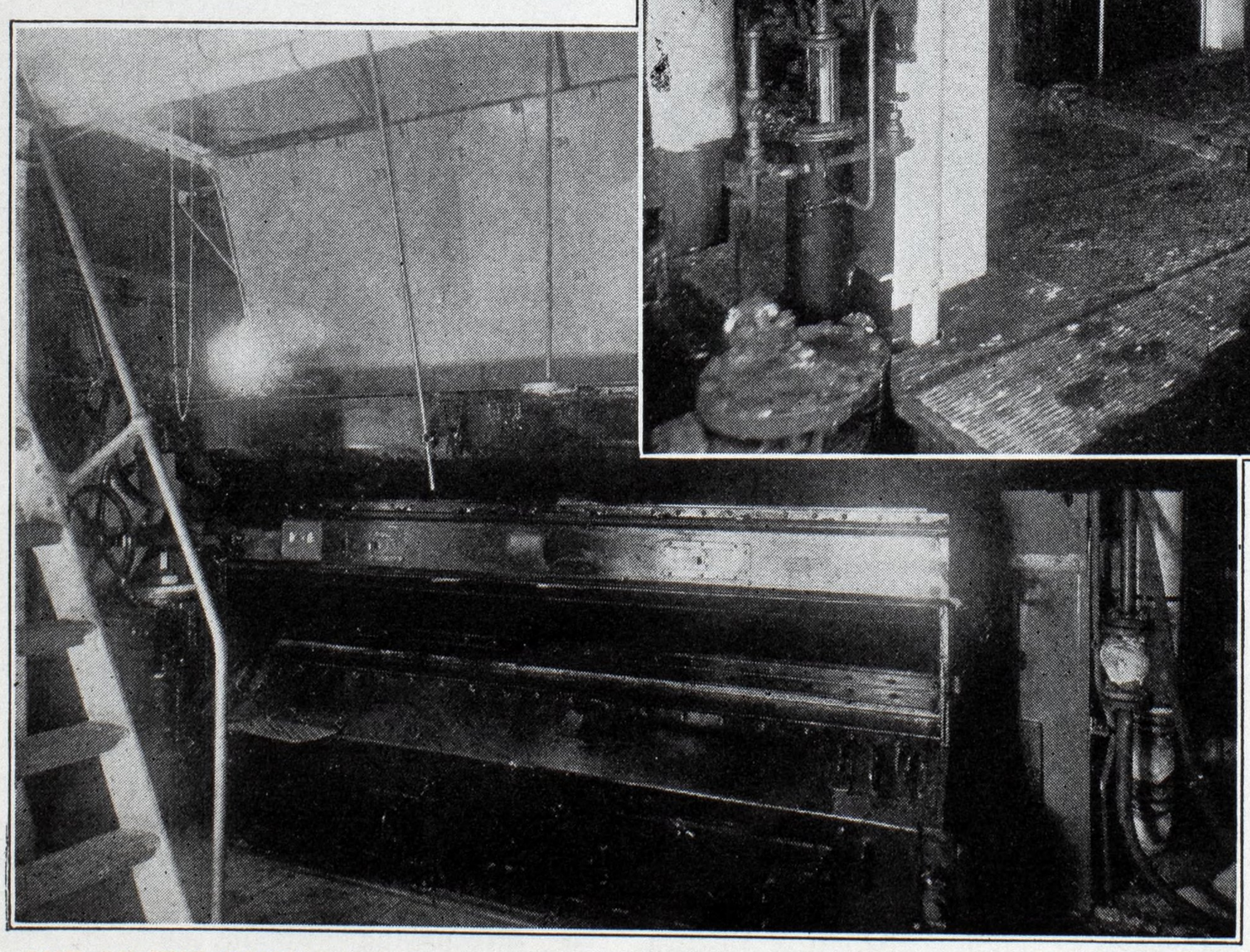
The main generating units are fitted with surface air coolers of General Electric make. The main motors are cooled by two American Blower Co. fans, each driven by a 25-horsepower alternating current motor. There is one of these fans for each motor and outside air is thus circulated through the motor windings.

In her steam generating plant the CITY OF SAGINAW 31 is modern in every respect. Steam is furnished by four Babcock & Wilcox watertube boilers, with interdeck superheaters, at a pressure of 315 pounds per square inch and 200 degrees superheat, and a total temperature of 625 degrees Fahr. Forced draft is used and each boiler is served by one American Blower Co. fan driven by a 7½-horsepower alternating current motor. Draft is maintained at from 1½ to 2 inches of air. Each boiler has 5020 square feet of heating surface, 452 square feet of superheating surface, and 120 square feet of grate surface. There is one row of four-inch tubes, other tubes are two inches in diameter. Each boiler is fitted with a Bailey meter. Coal is burned on Babcock & Wilcox chain grate stokers each driven by a 1½ horsepower direct current motor. Draft can be regulated in five compartments by means of dampers, thus insuring proper draft for different depths of fire.

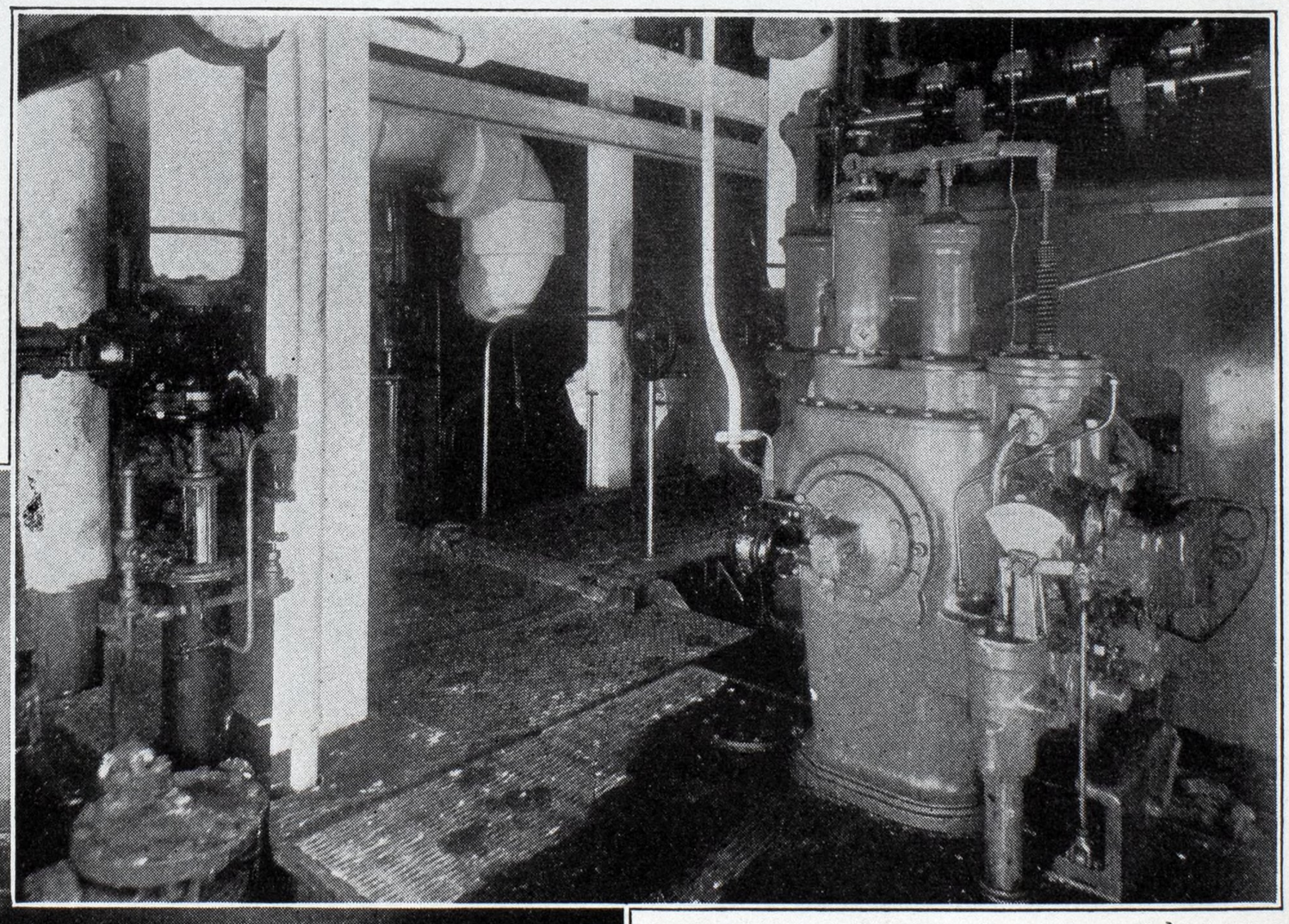
The coal burning arrangement on this vessel is of especial interest. The main coal bunker is located athwartships, forward of the boilers. Coal feeds from the main bunker on to a pan conveyor, designed and supplied by the Stephens Adamson Co. One of these conveyors operates on each side of the ship, elevates the coal and discharges it, through a crusher if desired, onto a gravity discharge type of conveyor which again elevates the coal and distributes it to fill the small bunkers on either side of the boiler room. These side bunkers contain enough coal for an ordinary run of the carferry so that the conveying system need only be operated while the vessel is in port. The coal from the side bunkers is fed to the hoppers of the stokers by means of a screw conveyor. The ash falls off the end of the chain grate into a combined crusher and conveyor, made by the Allen, Sherman, Hoff Co. From this point the ash is conveyed to a sump tank where it is mixed with water and pumped overboard.

One of the dangers encountered in the operation of carferries in the winter time is the shock given the machinery when the propellers strike

(*Continued on Page* 64)



ONE OF THE FOUR BABCOCK & WILCOX WATERTUBE, CHAIN GRATE, STOKER FED BOILERS ON THE CARFERRY CITY OF SAGINAW 31



ONE OF THE TURBINE CONTROL UNITS

On Modern Turbine Propulsion

High Speed High Efficiency Turbines—Moderately High Pressure and High Temperature — Geared Turbine and Turbine Electric Drive Compared

By W. E. Thau

THE purpose of this paper is to discuss modern turbine propulsion in the geared and electric drive forms. By modern turbines are meant the high speed, high efficiency turbines arranged for moderately high pressure and high temperature steam, operating in conjunction with efficient boiler condensing, and feed heating plants and, as far as economically practicable, electrically driven auxiliaries. These two modern forms are thus distinguished from the older and less efficient forms of direct-connected and low speed single reduction geared equipment.

We are tending progressively toward higher overall efficiency. The development of new designs and materials has made possible the present-day high speed turbine in which efficiency and reliability are combined in a high degree.

The marine industry finds itself in the fortunate position of being able to obtain two forms of modern steam propulsive equipments, both of which represent marked improvements over the older forms of steam drives. Due to the diversity of conditions to be met in applying machinery to ships, the selection of the type to be used usually requires a careful study and analysis in each specific case.

The first turbines applied to ship propulsion were direct-connected. There is even a recent example of this method. The direct-connected turbine at best is a compromise which is not justified today. All factors operate against its performance; the speed is too low for good efficiency; the blade clearances are relatively excessive resulting in wasteful leakage; moreover, since the direct-connected turbine is of necessity a large unit, the danger of distortion with consequent blade-rub is great, the weight and size are excessive, and such turbines require high skill in handling and maneuvering. In the effort even to approach high speed, at which the turbine is most efficient, there is the constant temptation to sacrifice the propeller efficiency. The direct-connected turbine has served its purpose in the development of the art and will probably not be used again in a new installation.

To overcome the objections of the low speed direct-connected turbine it was necessary to introduce speed reducing means. Two general methods are now available, namely, the reduction gear and the electric drive. Incidentally, both are considerably more than mere speed reducing means because of their flexibility in emergency reserve power, etc.

Nothing need be said here concerning the history of these developments, except that the geared turbine arrangement made its appearance before the turbine electric drive.

Choose Power on Merit

THIS is a valuable contribution to the literature of marine engineering. The broad and impartial manner in which the author has developed his subject is in the spirit of the true engineer searching for the best solution of each problem as it is presented without prejudice. Much favorable discussion was aroused and requests for additional information will bring out facts and data of value to the engineer. One of the outstanding features of this paper is emphasis on the necessity of studying each specific case in trying to arrive at a correct solution of the type of drive. As circumstances dictate it may be either steam or diesel, geared drive or electric. Properly designed and constructed machinery properly cared for can be successful in any type found most suitable for the particular job in hand.

The Geared Turbine Drive

The first geared turbines employed a single reduction gear. These, however, due to low propeller speeds, were recognized as not representing the most economical arrangement because the turbine speed was still below its most efficient value. Ninety revolutions per minute of the propeller necessitated an inefficient turbine speed with single reduction, as the highest practicable reduction ratio has been considered to be approximately 20:1. This led to double reduction gears and turbine speeds of about 3600 revolutions per minute. Unfortunately, some of the first double reduction installations gave trouble, and their adherents in Europe reverted to the single reduction arrangement. American engineers, however, analyzed the situation differently and overcame the troubles. Today the modern American practice favors double reduction in the case of low speed propellers.

Naturally, in cases where the propeller speed is high or where the power per screw is high in combination with reasonably high propeller speed, single reduction is entirely suitable and advisable. The chief requisite is to operate the turbine at its highest practicable speed, and this does not always require double reduction gears. The turbine as an efficient power producing means is inherently a high speed machine.

With due recognition of stresses and factors of safety when dealing with known materials, a high speed turbine is inherently a better proposition, from a cost, operating and maintenance standpoint, than a low speed turbine for the following reasons.

1. It is smaller and thus stiffer and more rigid.
2. It has relatively greater blade clearance per inch diameter.
3. It has a relatively higher first critical speed.
4. It has fewer blades.
5. It has less likelihood of defective workmanship.
6. It is less susceptible to distortion.
7. It is less apt to become misaligned.
8. In the multiple cylinder arrangement, fewer cylinders are needed in the higher speed arrangement.
9. Smaller and more rugged construction is conducive to greater flexibility in maneuvering, in that the turbine is able to successfully withstand greater abuse such as is caused by sudden starts and stops.

In addition to its better economy, the high speed turbine has decided advantages in cost, weight and space, all of which have their economic relations to operation of a ship.

The advantages of high speed turbines apply equally to geared and electric drives. In the case of geared drive the turbine usually is less influenced by other items of the transmission, and hence is less restricted. More is said of this in the discussion of electric drive.

Paper presented by W. E. Thau, manager of marine engineering, Westinghouse Electric & Mfg. Co., before the Society of Naval Architects and Marine Engineers at the annual meeting in New York City, Nov. 15, 1929.

There has been considerable research in connection with turbine blade materials, blade forms, blade fastenings, blade lashing, blade breakage, blade services, blade stresses, etc., during the past ten years. The results of this research are astounding. Where blade tip speeds of 500, 600 or 700 feet per second were considered as limits a few years ago, we not only find ourselves using blade speed today almost twice the former limit but at stresses and factors of safety of the same relative value. The old low speed turbine has been revolutionized, thanks to the pressure of economy. Strange as it may seem, the high speed, drum supported reaction blades are not the cause of any concern to specialized turbine manufacturers, nor to those who operate them.

Proper elasticity is desired in any form of drive. Vibrations are to be eliminated and guarded against to the fullest extent. Having designed, built and balanced a geared turbine equipment so as to effect vibrationless operation in itself, there is only one other source of probable disturbance, and that finds itself in the unbalance of the propeller or the performance of the propeller with respect to the action of the water and the resultant combined relation of the two on the stern of the ship. Torsional vibration is the only type which the geared arrangement will transmit to the ship that the direct drive turbine and the turbine electric drive will not. The two latter drives will dampen this type of vibration, whereas the former will not. Torsional vibration mentioned in gear drives has never proven to be serious. Vibrations due to unbalance of propeller or to other causes connected with the relative action of the propeller, such as the blades operating in the proximity of the hull, etc., will result in rough operation with any type of drive. This obviously is the problem with which the naval architect is concerned.

Properly controlled elasticity in the drive is, therefore, a much desired characteristic. In the geared drive this elasticity can be incorporated in the form of a flexible drive shaft between the turbine and the gear. Torsional elasticity is also desirable from the standpoint of shocks resulting from the striking of submerged objects by the propeller. There are cases on record where anchor chains have become entangled with the propellers and forces developed which were sufficient to move the gears off their foundations and partly shear the line shaft coupling bolts, without resulting in injury to the gear teeth or the turbine. Also, propeller blades have been broken off by striking submerged objects and the impact was sufficient to partly shear the coupling bolts with no damage to gear teeth or turbine.

No ship offers foundation facilities comparable with a land installation, where tons of concrete and steel can be used with impunity. An increasing number of marine engineers believe in heavy scantlings and welded construction as the best means of effecting the necessary rigidity in machinery foundations. In rough weather a machinery foundation in a ship is bound to be distorted to some degree or the shaft alignment become otherwise upset. It is, therefore, desirable to incorporate elasticity in the gears. This is best accomplished by the well-known flexibly supported pinion frame arrangement in which the pinion bearings are supported in a rigid frame which is carried on an "I" beam arranged in a plane at right angles to the axis of the pinion. In conjunction with the flexible pinion support is a flexible drive shaft and pin type coupling. These function in conjunction with each other to compensate for reasonable misalignment. The flexible drive shaft and the pin type coupling are used between the turbine and high speed pinion. A flexible drive shaft only is used between the first and second reduction gears in the case of double reduction gears.*

Intelligent detail analysis of vibrations is an item of relatively recent development, and even then we have much to learn in regard to vibration situation. We know, however, that the present design of geared turbine drive operates successfully.

A further important advantage of the flexibly supported pinion frame in conjunction with the flexible drive shaft is that it permits the pinion to take a position with respect to the gear which is nearly proportional to its torsional deflection and hence assure practically uniform pressure along the entire face width. Such distribution of load is impossible with the fixed bearing gear except at one load and one condition of alignment. What happens in the case of the flexibly supported pinion is that the pinion is free to rotate a small amount about an axis centered in the web of the "I" beam and thus avoid concentration of the load on one end of the pinion. Greater designed tooth pressures are possible with this arrangement than with the fixed bearing gear, not only with equal but better service of the installation. Consequently the result is not only reduction in size and weight of the gear, but the provision of means to correct for reasonable misalignment, two decidedly beneficial characteristics.

Broadly speaking, the following are the most economical arrangements of geared turbines for vessels of the usual requirements.

Geared Turbines for Vessels of Usual Requirements

Total S. H. P.	No prop.	Prop. R. P. M.	Gear arrangement	No. pinions	Turbine arrangement
8000	1	80	doub. red.	2	Cross compound
40000	2	125	doub. red.	2	Cross compound
100000	4	150	doub. red.	2	Cross compound
160000	4	200	sing. red.	3	Triple expansion
200000	4	225	sing. red.	4	Double cross compound or quadruple expansion

In cases where it is desirable to have good economy over a wide range of power and speed, the triple flow arrangement is the most advantageous in that its flexibility affords a practically flat water rate performance from 100 to 10 per cent rated shaft horsepower and 100 to 50 per cent ship speed. In a specific case of 20,000 shaft horsepower per screw, the maximum and minimum performance over this range differed less than 3 per cent.

In most cases, however, the cross compound arrangement gives reasonably flat performance over the range at which any ordinary commercial ship is required to operate.

In case of casualty to one of the turbine units or to one of the high speed gear reductions it is possible to develop approximately 60 per cent power with the remaining element of a cross compound arrangement, and approximately 75 per cent power with the two remaining elements of a triple expansion arrangement. In this respect the geared turbine arrangement possesses attractive flexibility in reserve power in case of casualty to any part except the main gear.

Turbine Electric Ship Drive

The turbine in the case of the electric drive differs from that in the gear drive in the following respects:

*See paper by Ira Short presented at joint meeting of A. S. M. E. Machine Shop Practice Division and the American Gear Manufacturers' Association, Buffalo, October 12, 1928.

(*a*) The operation is in only one direction and hence the turbine has no astern element.

(*b*) The complete expansion of the steam is effected in one cylinder. This condition in the large powers necessitates lower speed turbines than in the case of multiple cylinder geared units. This is further influenced in some cases by the practice of operating below the critical speed. In the case of the reaction turbine generator set the generator critical is lower than that of the turbine and from this standpoint the generator critical speed is usually the determining factor. By operating through the critical speed some saving in cost, weight, space and economy would result. Mechanically the turbine generator set is arranged with three or four bearings, the latter arrangement being used in the larger sizes.

Thus far, no attempt has been made to use other than a complete expansion turbine in the case of electric drive, although both the tandem compound and the cross compound have been considered, the former with a single generator and the latter with the generator arranged in two parallel operated units.

Parallel operated complete expansion units have also been given consideration in certain cases of single screw ships where reserve power in event of casualty was regarded as mandatory. This arrangement, however, adds considerably to the expense and, besides, complicates the operation and arrangement. It is not recommended.

Substituting a cross-compound arrangement, in which each unit is of half capacity, for a complete expansion arrangement of full capacity would permit higher turbine and generator speeds, with consequent improvement in economy; however, it entails complication in operation and additional space, weight and cost, which more than counteract the gain in economy.

The tandem-compound arrangement merely provides reserve power in the event of casualty to a turbine and has little, if anything, to commend it.

All things being considered, it appears as though the best turbine arrangement for electric drive installations is to use complete expansion turbines, one generator set for each propeller motor in the case of twin screw ships. In the case of quadruple screw ships, two or four generator sets are used, depending largely on the power and flexibility desired. When driving inboard and outboard screws with one generator set, it is either advisable to design the inboard and outboard screws differently so that they will divide the power equally, or to incorporate additional power in the inboard or all motors. One or the other of these arrangements is necessary because the inboard screws, when of the same design as the outboard screws and operated at the same speed, will absorb more power than the outboard screws. The amount of difference in the power absorbed between the inboard and outboard screws depends, obviously, on the relative wake action. Cases are on record in which the inboard screws absorbed approximately 15 per cent more power than the outboard screws when operated at the same revolutions per minute.

Since the synchronous motor is suitable for at least all ordinary ships, that form alone has been considered in this discussion. The induction motor drive is heavier, more expensive and slightly less efficient in operation; however, experience has shown that it is not required in any except unusual ships.

Electric or Geared Drive

During the past year the marine technical press has been replete with articles dealing with the merits and demerits of the two systems under discussion. In discussing a subject of this character it must be clearly recognized that both types have certain inherent good characteristics which might be overlooked, or not properly evaluated. The electric drive advocates stress such factors as reliability, maintenance, ease of control, maneuverability, astern power, vibration, etc. The geared turbine advocates emphasize some of the same factors and include such items as first cost, operating cost, less complication, weight, space, etc. The major factors under discussion are briefly analyzed below.

(*a*) *Dependability or Reliability.*—This item is probably the most important. When all factors are considered I believe there is little, if any, difference between properly designed and constructed modern drives of either type. In making a comparison of the reliability of two drives we must be careful to adhere to modern types and not go back to the early installations which in reality are steps in the development, and this applies in both cases. The proof lies in the fact that there are plenty of successful installations of both types in service.

(*b*) *Maintenance.*—This item in a sense is essentially a corollary of dependability. Here an unbiased search considering all cases on their merits and in proper proportion will show about an equal standing, particularly in the more modern installations. An item of improper design, material, construction or operation should be duly recognized as such.

(*c*) *Operation.*—Either type properly operated will give satisfaction. It is a case of knowing the installation and its limitations.

(*d*) *First Cost.*—The first cost when based on modern efficient machinery is for the ordinary type of ship in all cases in favor of the modern, efficient geared turbine. Strange as it may seem, the costs of the older and less efficient arrangements of geared turbine drives using low speed turbines are more nearly in line with those of the turbine electric.

(*Continued on* Page 60)

Fuel Rate Calculations for 5000 S. H. P.—Single Screw

	Geared turbines			Turbine electric	
	A	B	C	D	E
Condensate temperature, deg., F.	88	88	88	88	88
Rise in air ejector cooler, deg., F.	10.6	10.6	11.1	10.0	10.3
Rise in feed tank, deg., F.	24.7	24.9	25.0	24.8	24.7
Rise in L. P. heater, deg., F.	81.7	81.5	80.0	82.2	82.0
Rise in H. P. heater, deg., F.	95	95	95	95	95
Final F. W. temperature, deg., F.	300	300	300	300	300
Steam to air ejectors, lb./hr.	400	400	400	400	400
Steam to main cond., lb./hr.	36,000	37,500	36,000	37,000	39,000
Steam to aux. gen. lb./hr.	1,700	.....	*	3,130	.....
Steam to main feed pump, lb./hr.	1,750	1,750	1,750	1,750	1,750
Steam to misc. heating, etc., lb./hr.	2,000	2,000	2,000	2,000	2,000
Steam bled to L. P. heater, lb./hr.	1,630	1,610	1,450	1,900	1,775
Steam bled to H. P. heater, lb./hr.	4,800	4,800	4,600	5,100	4,950
Steam from boilers, lb./hr.	48,280	48,060	46,200	51,280	49,875
Power developed by main units, S.H.P.	5,020	5,070	4,995	5,035	5,000
Power developed by aux. gen., Kw.	100	100	100	184	184
Boiler efficiency, per cent	85	85	85	85	85
Heat value of fuel, B.t.u./lb.	19,000	19,000	19,000	19,000	19,000
Heat rate—steam only, B.t.u./S.H.P./hr.	10,425	10,270	10,025	11,040	10,820
Fuel rate—all purposes, lb./S.H.P./hr.	0.646	0.637	0.633	0.685	0.670
Fuel rate—corrected for price of diesel oil using 1.5 differential, lb./S.H.P./hr.	.....	.....	0.639	.....	.....

*62 lbs. fuel oil per hour to diesel engines.
A and D=Auxiliary current supply from condensing turbine driven generators.
B=Auxiliary current supply from generator driven by the main unit.
C=Auxiliary current supply from diesel driven generators.
E=Auxiliary current supply through transformers from main units.

Theodore Elijah Burton
1851-1929

The universal eulogy and rare tributes paid the late Senator Theodore E. Burton, who died in Washington on Oct. 28, were the deserved culmi-

Courtesy of Cleveland Town Topics

nation of long and faithful public service in both branches of congress affecting all citizens. Senator Burton had been in political office for nearly 40 years, during which period he was an outstanding figure and a leader in almost every great public issue before the country and served in international assemblies dealing with world finance of war or peace.

He will probably be remembered nationally chiefly as the eminent authority on inland waterways. President Hoover eulogized Senator Burton in the following remarks:

"I personally feel deeply the absence of Senator Theodore Burton, at whose bedside in Washington I recently stood. His work as chairman of the historic inland waterways commission, appointed by President Roosevelt in 1907, gave the foundation upon which this great development has been created. The report of that commission in 1908 has been the bible of waterways improvement. Its first result was the act of 1910, with which began the present project, now brought to successful conclusion. It reflected not only the clarity of mind with which the senator has endowed public issues for a generation, but also the broad humanity of his spirit that dwelt with especial concern upon the problem of equity involved, and upon the welfare of the whole body of men and women of the country, for whose benefit the program was primarily undertaken."

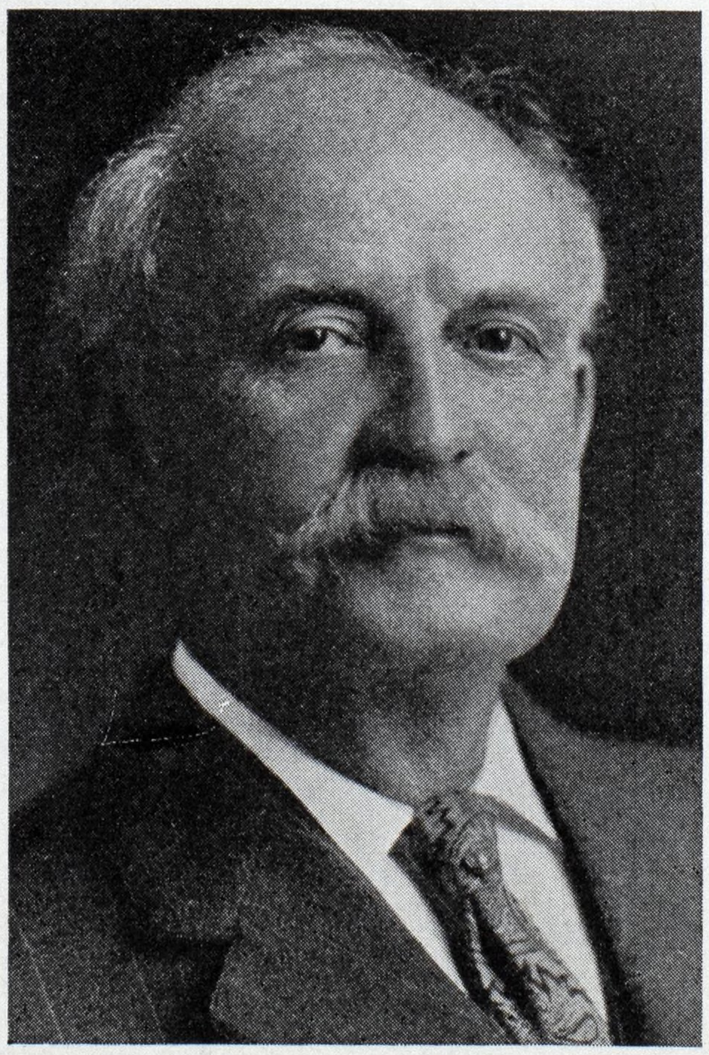
Senator Burton was born in Jefferson, O., Dec. 20, 1851 and was first elected to congress in 1888. He never married. His body lay in state in the Senate chamber, Washington, on Oct. 30 and again in Public Hall, Cleveland, on Oct. 31, and interment was made in Lakeview cemetery in Cleveland.

William Liston Brown
1842-1929

William L. Brown, 87, one of the founders of Pickands, Brown & Co., Chicago, died at his home in Pasadena, Cal., Nov. 1, where he had lived before and since he retired from active business about Jan. 1, 1925.

In 1890 Mr. Brown organized and became president of the Chicago Shipbuilding Co. and in 1899 he was elected president of the American Shipbuilding Co., later also serving as chairman of the board.

He was born in St. Joseph, Mich., Aug. 23, 1842. In 1883 with Col. James Pickands, Major H. S. Pickands, Samuel Mather and Jay C. Morse he organized Pickands, Brown & Co., becoming its president and remaining in that office 42 years. He was a director of the First National Bank, the First Trust & Savings bank and the By-products Coke Corp.



of Chicago and several furnace and iron mining companies. He was a member of the American Iron and Steel institute, the Society of Naval architects and Marine Engineers, as well as numerous clubs. Funeral services were held in Chicago on Nov. 5.

Thomas Franklin Newman
1853-1929

Thomas F. Newman, president of the Cleveland & Buffalo Transit Co., and well known in Great Lakes shipping circles, died after a month's

illness in Cleveland on Nov. 6. He was 76 years old.

Mr. Newman's rise from general utility boy for the Detroit & Cleveland Navigation Co. to the founder and president of the Cleveland & Buffalo Transit Co. involved 60 years of hard work.

In 1893 he succeeded in interesting a group of wealthy men in the possibilities of a boat line from Cleveland to Buffalo and incorporated the Cleveland & Buffalo Transit Co. Active service was begun that year with two ships purchased from the D. & C. line. He served as general manager of the new company until 1925.

In 1927 Mr. Newman celebrated his fiftieth anniversary in Great Lakes shipping. It was a source of pride to him that every captain, chief engineer, pilot and assistant chief engineer on the C. & B. boats came up under his tutelage and he was happy in the possession of the steamer SEEANDBEE, the largest fresh water passenger boat in the world when launched in 1912 and still one of the largest on the Great Lakes.

Mr. Newman was a director and former president of the Great Lakes Towing Co., director in the Cleveland Wire Spring Co. and a former member of the Cleveland harbor commission. He is survived by one son, James G. Newman, and three nephews, H. B. Rogers, George Lance and Frank Lance, all of Cleveland.

Japanese Liner Enters Service

Quadruple Screw Diesel Liner Asama Maru—First of Three to Enter Transpacific Run—Outstanding in Speed, Safety and Luxury

THE new Nippon Yusen Kaisha motorship, the ASAMA MARU, which arrived in San Francisco, Oct. 24, completing her maiden voyage from Yokohama via Honolulu in a day less than schedule and making the fastest known crossing, is the first of three new ships of 17,000 gross register tonnage to enter the N.Y.K. service. On her first voyage this vessel carried 5575 bales of silk, valued at $6,000,000. The ASAMA MARU and her sister ships, the TATSUTA MARU and the CHICHIBU MARU, will be the largest, fastest and most luxurious liners crossing the South Pacific.

On her trial trip the ASAMA MARU developed a speed of 21 knots and her sister ships are expected to average the same, which will constitute a new record for Pacific travel.

The ASAMA MARU is the last word in ocean luxury. She is 584 feet long, has a beam of 72 feet and will accommodate 839 persons in the three classes. She is equipped with four Sulzer diesel engines that develop 16,000 horsepower and is driven by quadruple screws.

Among the numerous salons is the Japanese room that adjoins the verandah on the starboard side. This is the first time a steamship company has ever placed on an ocean going vessel a real Japanese room with the ceremonial Tokonoma (alcove) and the Fukurotodana (cupboard) and other Japanese fittings. This will give passengers their foretaste of Japan before reaching the country itself. From time to time Sukiyaki parties, that novel feast a la Japonaise, will be held. Besides the Japanese room, first-class passengers will enjoy the verandah at the end of the port deck, which is the uppermost of the seven decks; the reading and writing room are decorated in the graceful English style of William and Mary period; the lounge or great salon situated amidship on "A" deck, is decorated in Georgian style. There is a smoking room, a nursery for the children representing the exterior of a small cottage in an English village, a dining salon at the center of "C" deck, also decorated in the early Georgian period, a swimming pool and a large gymnasium.

Another new feature is the establishment of a branch office of the Sumitomo Bank on board the ship. The ASAMA MARU and her sister ships will be the first liners on the Pacific to have a branch office of a bank on board.

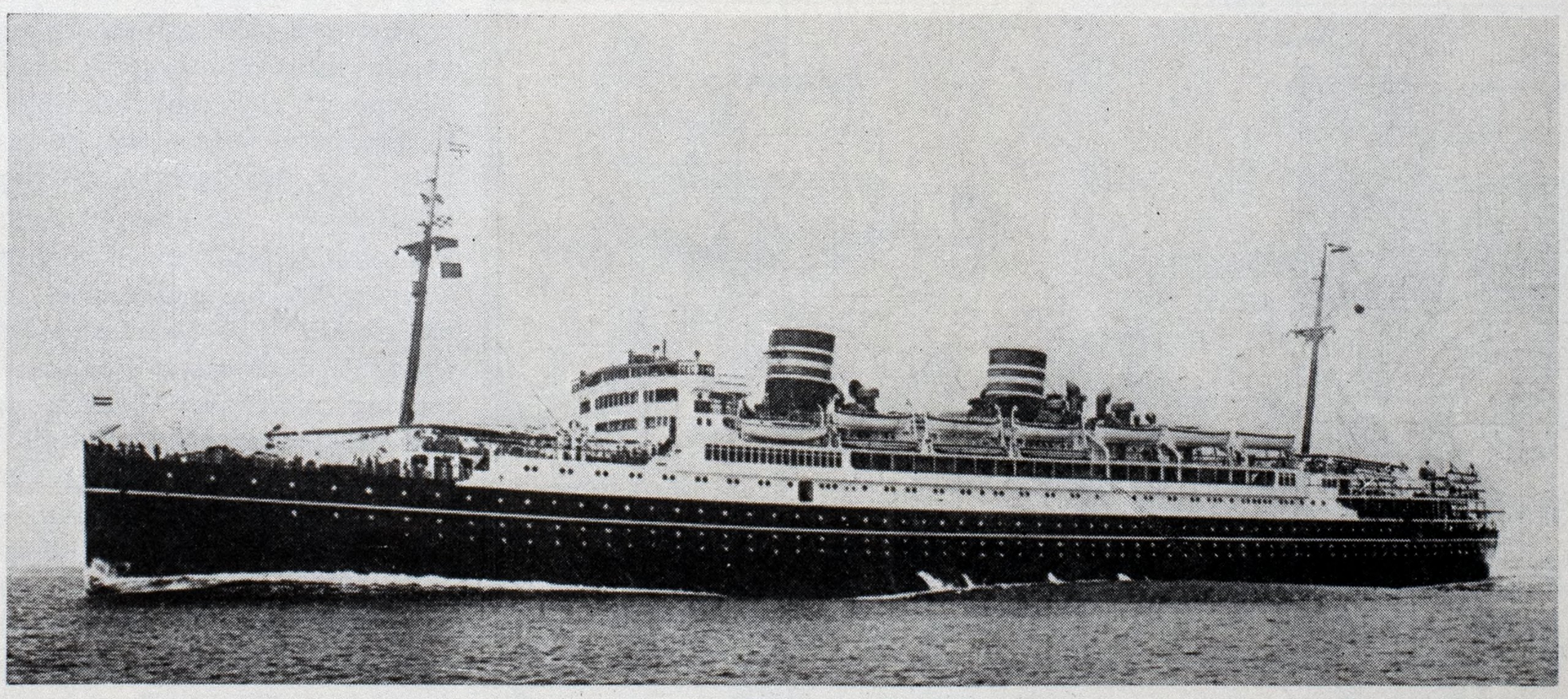
All the first-class staterooms (more than 100 in number) are outside rooms, accommodating from one to four passengers. Many have private baths. All are beautifully furnished and fitted with beds instead of berths. The latest Thermotank Punkah louvre system of ventilating is installed throughout the passenger quarters to insure comfort, no matter what the change in climatic conditions on the ship may be.

Moreover, all the cooking, heating, etc., is done by electricity to keep the vessel entirely free from coal dust or soot.

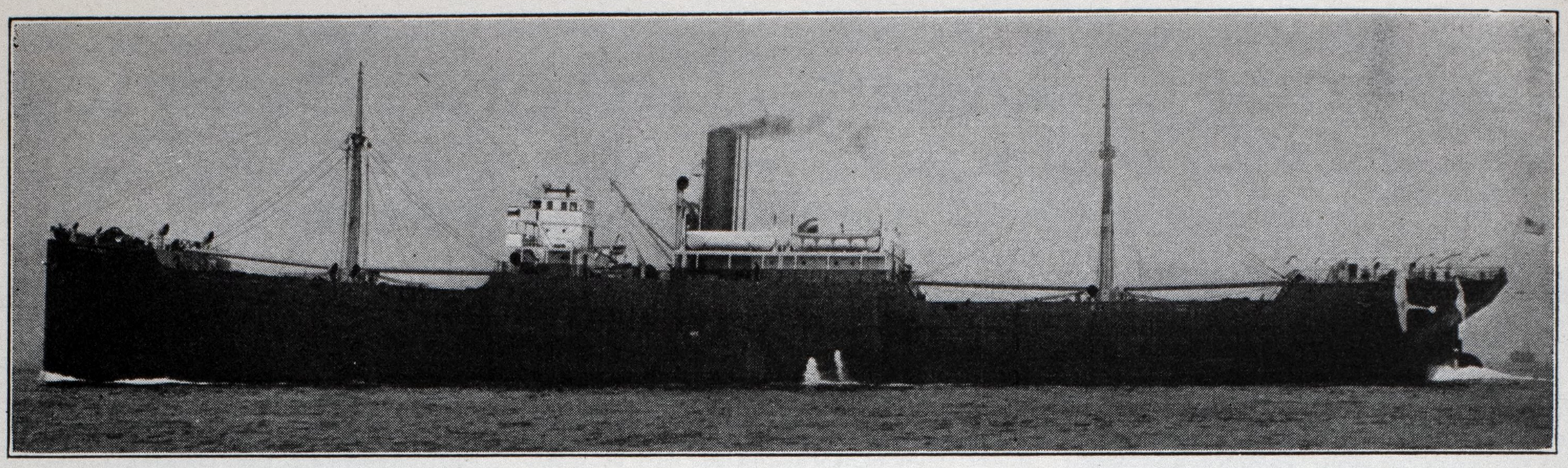
Most capable employes have been selected by the company for these three ships. All of the officers, including the captains, pursers, stewards and chefs, have been sent abroad to study in American and European hotels, as well as on other steamships operated on the Atlantic and the Pacific, in order that they might discharge their duties most efficiently.

In planning the ASAMA MARU, the TATSUTA MARU and the CHICHIBU MARU, the utmost attention has been paid not only to comfort and speed, but to safety. Ten watertight bulkheads, a gyro compass, a radio direction finder, two motor life boats with wireless installation and searchlights, are included in the equipment to insure security and stability of the ship.

The ASAMA MARU and the TATSUTA MARU were built in Japan by the Mitsubishi Shipbuilding yard at Nagasaki, and the CHICHIBU MARU at the Yokohama Dockyard. The latter two ships will be placed in commission later in the year.



Japan's latest motorship the Asama Maru arrived at San Francisco Oct. 25 on her maiden voyage



Shipping Board Steamer West Alsek Completed Her Second Transatlantic Voyage Burning Pulverized Coal, Nov. 19, 1929

Pulverized Coal for Marine Use

Late Developments in Shipboard Application of Pulverized Coal—Improvements in Mechanical Details—Principle Established on Sound Basis

By John Gardner

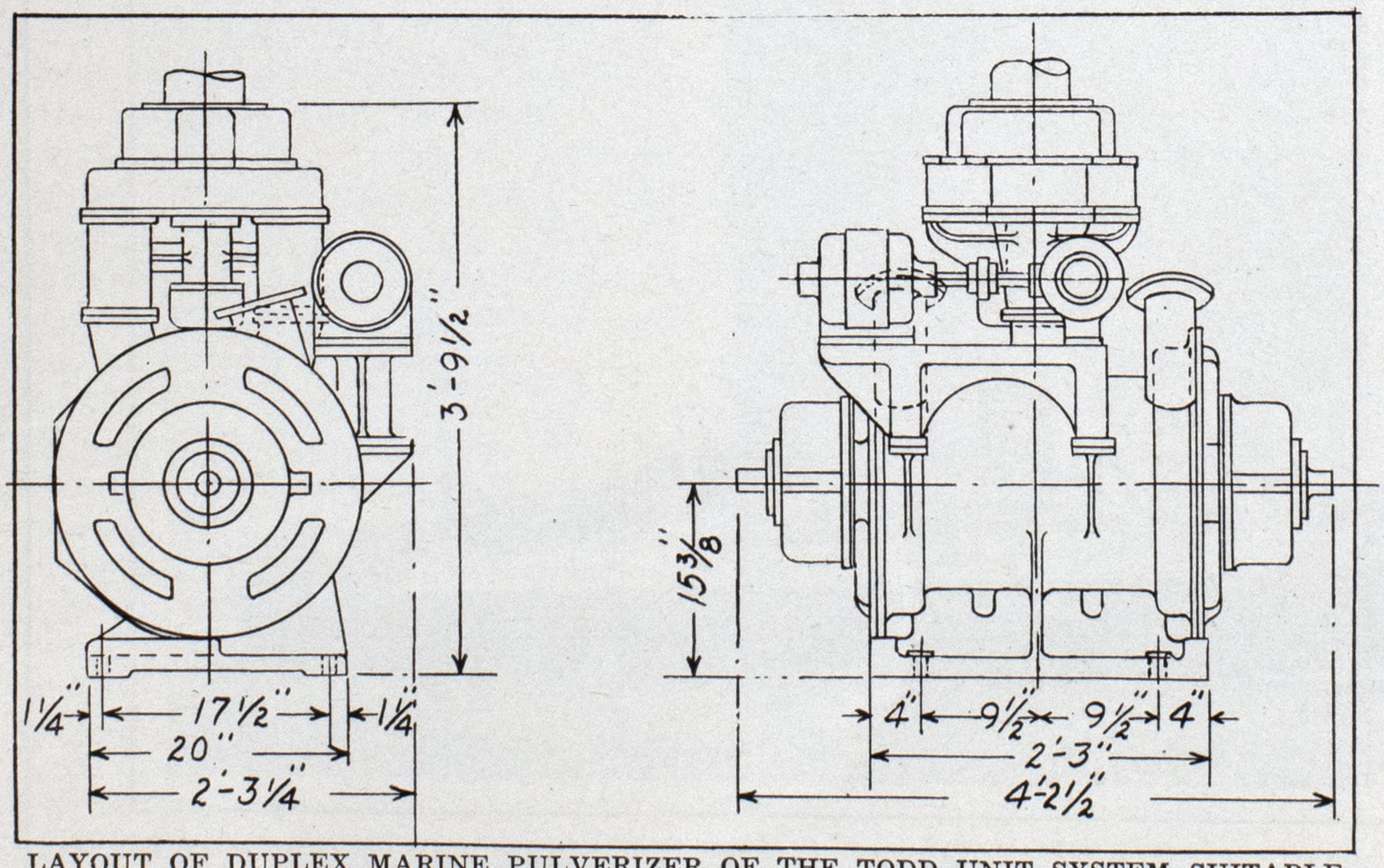
THE major elements entering into the process of burning pulverized coal aboard ship were established on such a firm basis through the experiments carried on in recent years by government and private agencies that there remained only details of a minor nature that could be subject to further development through practical experience.

The fact that pulverized coal can be successfully and economically burned in the confined furnace volumes of a ship's boiler is now history; that coals of low value for hand firing can be used for pulverizing with excellent results is also well known and established; the details of the means adapted to do these major things are matters that were subject to development to the end that they be brought within the region of accepted practice as understood or desired by the operating engineers.

SINCE coal is still the fuel used in a vast majority of merchant ships and since any reduction in the cost of operation affects the successful conduct of business we are greatly impressed with the value of the practical results recently achieved in burning pulverized coal on shipboard. This article, written by an engineer of high standing in his profession and one who through years of development work leading to successful practical application of pulverized coal burning on ocean going ships, can well qualify as an authority, is therefore presented with the sole purpose of giving dependable information.

—Editor's Note

The author, John Gardner, is chief engineer of Todd Shipyards Corp. This article was especially prepared for MARINE REVIEW, at the request of the editor.



LAYOUT OF DUPLEX MARINE PULVERIZER OF THE TODD UNIT SYSTEM SUITABLE FOR A TWO-FURNACE BOILER

The moving of the coal from the bunkers to the pulverizers is one of the details that requires most earnest thought, because if the use of coal moving machinery becomes a necessity, it is essential that it must be rugged and inexpensive and it is easily understood that in many converted ships the bunkers were located with regard to ample capacity and coal trimming possibilities with reference to hand fired jobs rather than with any idea of burning pulverized coal; this is one of the details that has no ready-at-hand solution and in all like-

The shipowner who puts aside the economies already made possible through practical application because he hopes for the ultimate in the way of detail development before taking advantage of present possibilities has lost the vision of progress and economy. It can be stated with a feeling of security that the development of details in the process of burning pulverized coal is something that only time and experience can fully answer because these details are made up primarily of elements not entering into the major items but are matters brought into being on account of the varying conditions found on each individual installation, all of which are mechanical and therefore lend themselves to solution.

There are three major elements entering into this process, namely, the moving of raw coal from the bunkers to the pulverizers; the pulverizing of the coal; the burning of the coal in the furnace.

lihood will remain a conversion problem.

Ships built with a view of burning pulverized coal and bunkering either slack coal or run-of-mine coal present no serious problem along this line since they can be easily arranged with self-trimming bunkers and thus avoid the use of coal handling machinery.

ing three furnaces; there are three such groups used as there are three boilers.

To all appearances the size and weight of these units would suggest their ready application to any fire room, yet it has been found necessary to reduce both size and weight if they

The S. S. WEST ALSEK has now completed two transatlantic voyages in regular schedule service and on both of these a savings of importance in fuel and labor has been accomplished. As facts concerning economies are more desirable to any ship owner than abstract theories, the per-

Pulverized Coal Burning Data—S. S. West Alsek

THE S. S. WEST ALSEK arrived New York Nov. 10, 1929, completing her second round voyage as a pulverized coal burner to Glasgow, Avonmouth and other British ports. The coal burned eastbound was American coal of 14,015 B.t.u. and 10.8 per cent ash, 31.6 per cent volatile. Coal burned westbound was Scotch coal of 11,600 B.t.u., 17.3 per cent ash and 32.4 per cent volatile.

HEAVY weather was encountered through 75 per cent of the round voyage and is reflected in the propeller slip which is normally 5 per cent; on this voyage the ship averaged 12.9 per cent eastbound and 17.5 per cent westbound and at times going up to 58 per cent; the average speed for the round voyage, was 8.54 knots, which compares to 9.58 for the first voyage in normal weather; the average revolutions of the engine were the same as on the first voyage.

THE consumption eastbound was 417.1 pounds per mile as against 449 pounds average for the first round voyage, or an additional saving over the first voyage of 7.1 per cent. The consumption westbound, burning Scotch coal, which was a hard coal, difficult to pulverize and burn, was 505.5 pounds per mile, an increase over the average for the first round voyage, but in view of the weather conditions and the very poor quality coal burned, this is considered a very good showing.

THIS Scotch coal was burned alone and without mixing it with the better coal; had the same quality coal been burned on the westbound voyage as on the eastbound voyage, the consumption would have been 380.6 pounds per mile, with a decrease of 15.2 per cent over the first round voyage average. All coal burning machinery performed in a satisfactory manner and in view of the weather conditions, it has established itself as a thorough sea-going job.

THE United States shipping board fuel conservation committee and the Consolidated Navigation Co., managing operators of the Oriole line for the board, are to be congratulated for their helpful co-operation in establishing the burning of pulverized coal as an entirely safe, economical and dependable fuel for use on shipboard.

When considering the mills used to pulverize coal, very careful attention should be given to the type to be used.

The space in the usual fire room aboard ship is not more than necessary to carry on with hand firing; this varies with different ships and when conversion to pulverized coal is considered, it is only reasonable if the owner requires that all the necessary apparatus must be confined to this space, therefore consideration must be given to the size and space occupied by this equipment.

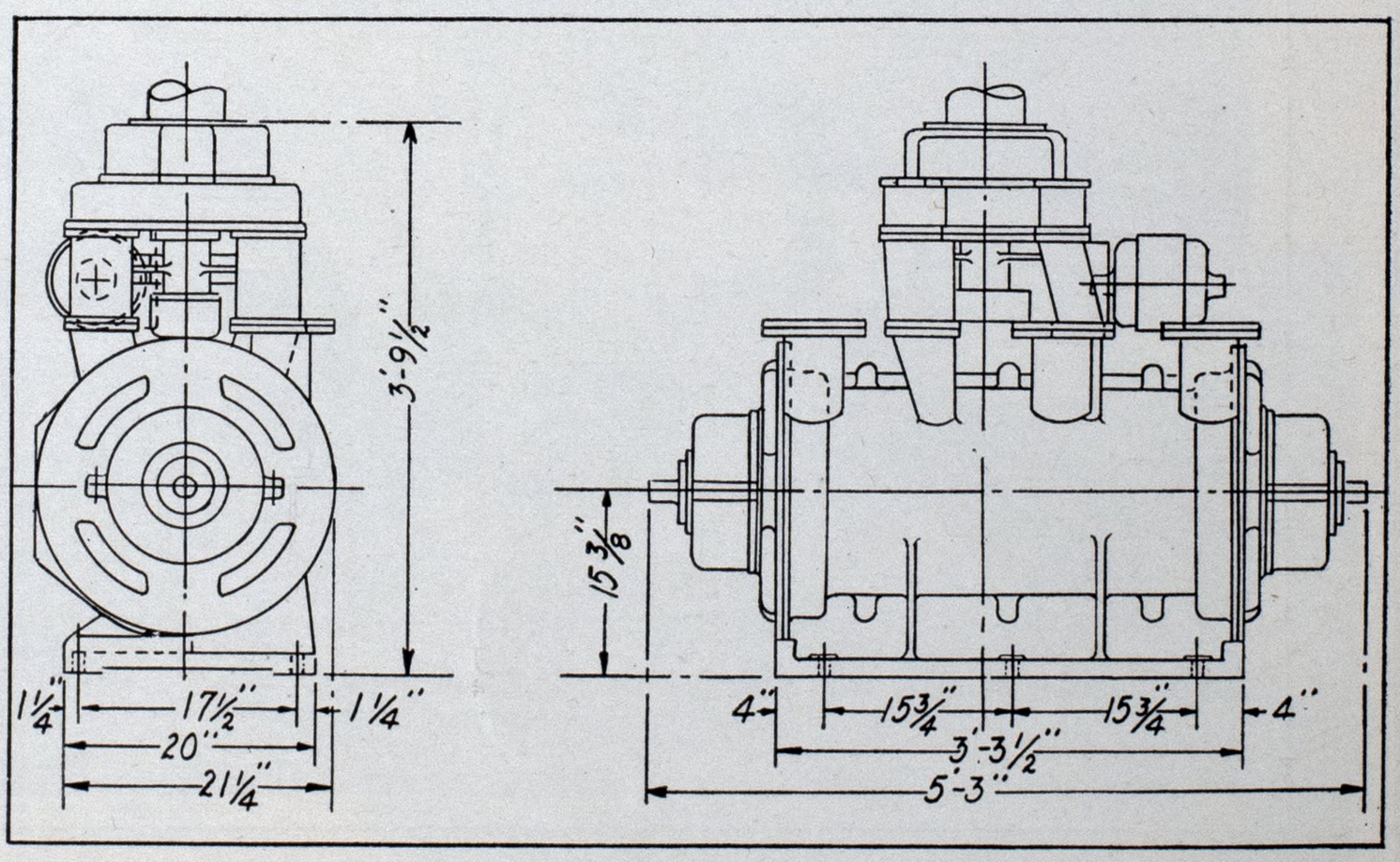
The burning of the pulverized coal in the furnace is no longer in the experimental stage; the greatest problem met with in the pioneer days was that of proper distribution of coal to the various burners, this problem has been entirely solved by the unit system in which a separate mill is provided for each burner and a separate coal feed for each mill and all so arranged that firing a required amount of coal to any of the burners can be accomplished with certainty.

The S. S. WEST ALSEK, now engaged in the North Atlantic trade, is an example of a converted ship in which the Todd unit system of pulverized fuel burning is installed entirely within the fire room space; the mills are light yet rugged and are so arranged that a group of three mills is driven by a steam turbine, this comprises a group for one boiler have to be adaptable to many existing fire rooms. For this reason the Todd Shipyards Corp. has developed a machine which is a combination of two, three or four mills all within the same casing; all the essentials of the original unit type mill have been retained and at the same time the weight has been reduced one-third and the space one-half of that necessary for the separate mills; here is a development of paramount importance to shipowners and engineers.

formance of the WEST ALSEK is therefore given as being of interest in this regard.

On the first round voyage this ship accomplished an economy of 38.9 per cent in cost of fuel per mile and reduced the fire room crew 20 per cent and increased the speed 9 per cent and the indicated horsepower 20 per cent.

On the second voyage, in heavy weather, the performance was bettered by reduction in fuel consumption of 11 per cent less than on the first voyage.



LAYOUT OF TRIPLEX MARINE COAL PULVERIZER OF THE TODD UNIT SYSTEM SUITABLE FOR A THREE FURNACE BOILER

Ship Repair Plant at Baltimore

Modernization of Baltimore Dry Docks Plant Completed—Every Facility for Efficient Ship Repairs Installed—Order and Cleanliness Prevail

By George A. Richardson

THE newly completed Baltimore Dry Docks works of the Bethlehem Shipbuilding Corp. Ltd. is one of the most modern and best equipped plants of its kind on the East Coast. It is designed to fill the needs of any size of vessel coming into Baltimore harbor.

Bethlehem acquired control of this property Oct. 1, 1921, and immediately started to make plans for the acquisition of additional land and the enlargement of the plant so as to thoroughly modernize it in every particular. Actual construction work started in February, 1928.

To begin with some of the unusual features in the way of refinements of detail warrant special mention. They are as follows:

1. Electrical outlets. All piers are fully equipped with suitable outlets for every kind of portable equipment, such as saws, welders, etc.

2. Unusually good lighting facilities. Night work to be efficient requires plenty of good lighting. Every provision has been made to adequately meet this requirement by the proper installation of floodlights and other auxiliary lighting equipment.

3. Protection against fire. The indirect losses resulting from fires are oftentimes greater than the direct ones, and efforts made to reduce the normal hazards are more than warranted. At this plant the foam fire fighting system gives unusual protection. Outlets plainly marked in red are provided at each dock.

4. Belt drives entirely eliminated. Every machine in the plant is individually motor driven.

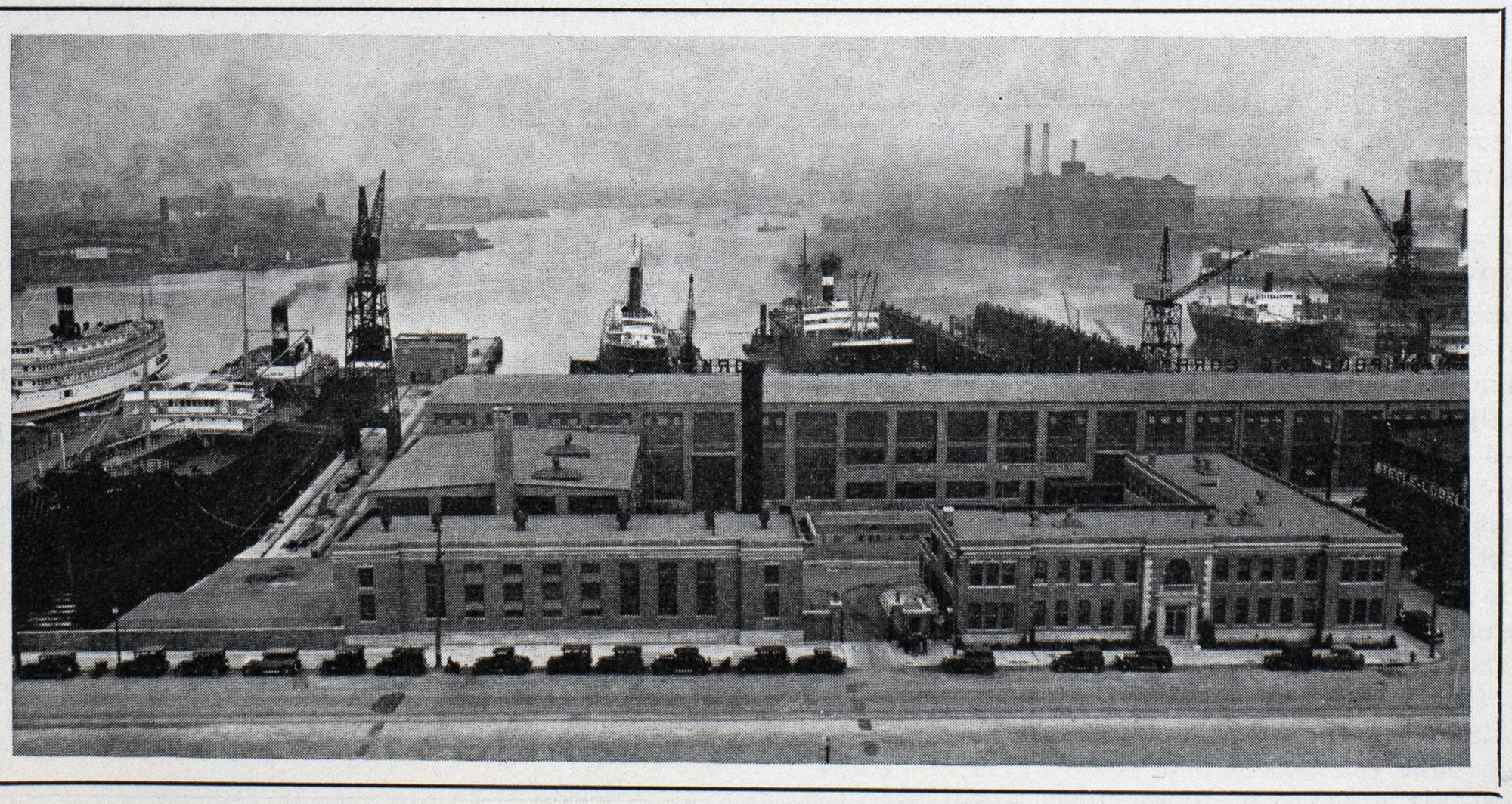
The main office building consists of a two-story L-shaped brick building, having a frontage of 120 feet and a maximum depth along the side leg of the same amount.

An important unit is the power house, which is 120 feet long by 40 feet wide. It is fully equipped to take care of the maximum peak power demands of the works, as well as the heating of the various units. Thirteen thousand two hundred-volt, 25-cycle, three-phase current, obtained from the local gas and electric company, is stepped down to meet the varying requirements, equipment for this purpose being located in a gallery at one end. Here are found one 100-kilowatt 120-volt direct current motor-generator set, used for supplying current to ships in the yards, and two six-phase 300-kilowatt 250-volt direct current synchronous converters, which take care of the requirements of the cranes and all miscellaneous demands throughout the shops.

All the metalworking shops are housed in an S-shaped building, having a maximum length of 600 feet, a normal width of about 80 feet, and a maximum overall width at each end of 180 feet.

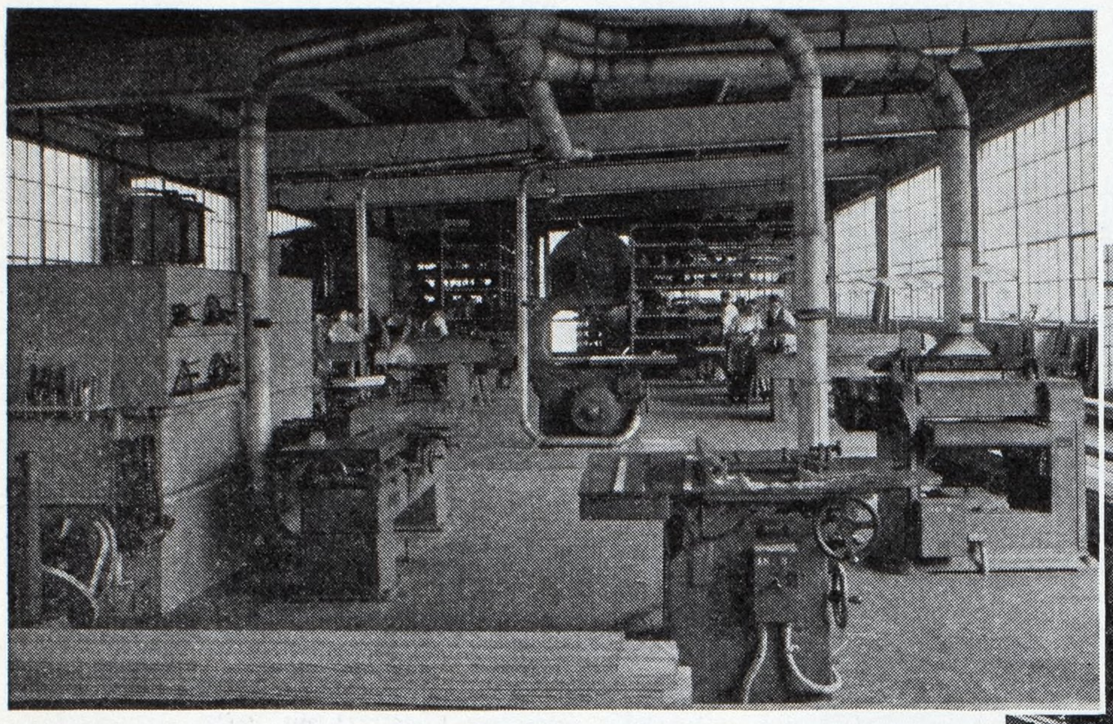
The pipe shop, copper shop, and brass foundry are located in the north leg of the S. The pipe shop is equipped to do any class of work on pipe from ⅛-inch up to 12 inches in diameter. The more important items of equipment include: two 4-inch threading and cutting machines; one 6-inch threading and cutting machine; one 8-inch threading and cutting machine; one 12-inch threading and cutting machine; one 14-inch drill press; one 22-inch drill press; one pipe expander (1-inch to 8 inches); pipe bending is taken care of on 294 square feet of bending slabs, serviced by four oil burners and one portable torch.

The machine shop division includes the machine shop proper, a tool room and a second floor section where the



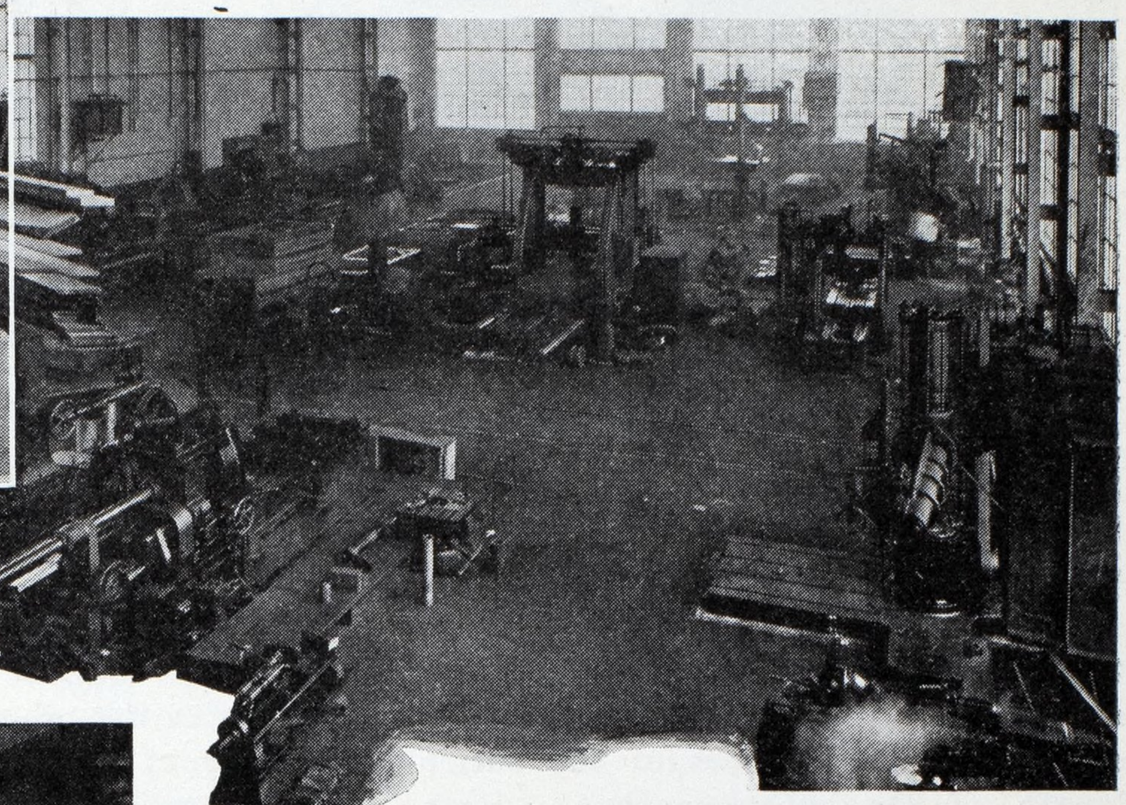
General View of the New Baltimore Dry Dock Plant of the Bethlehem Shipbuilding Corp.

Modern Shops at Baltimore Dry Docks



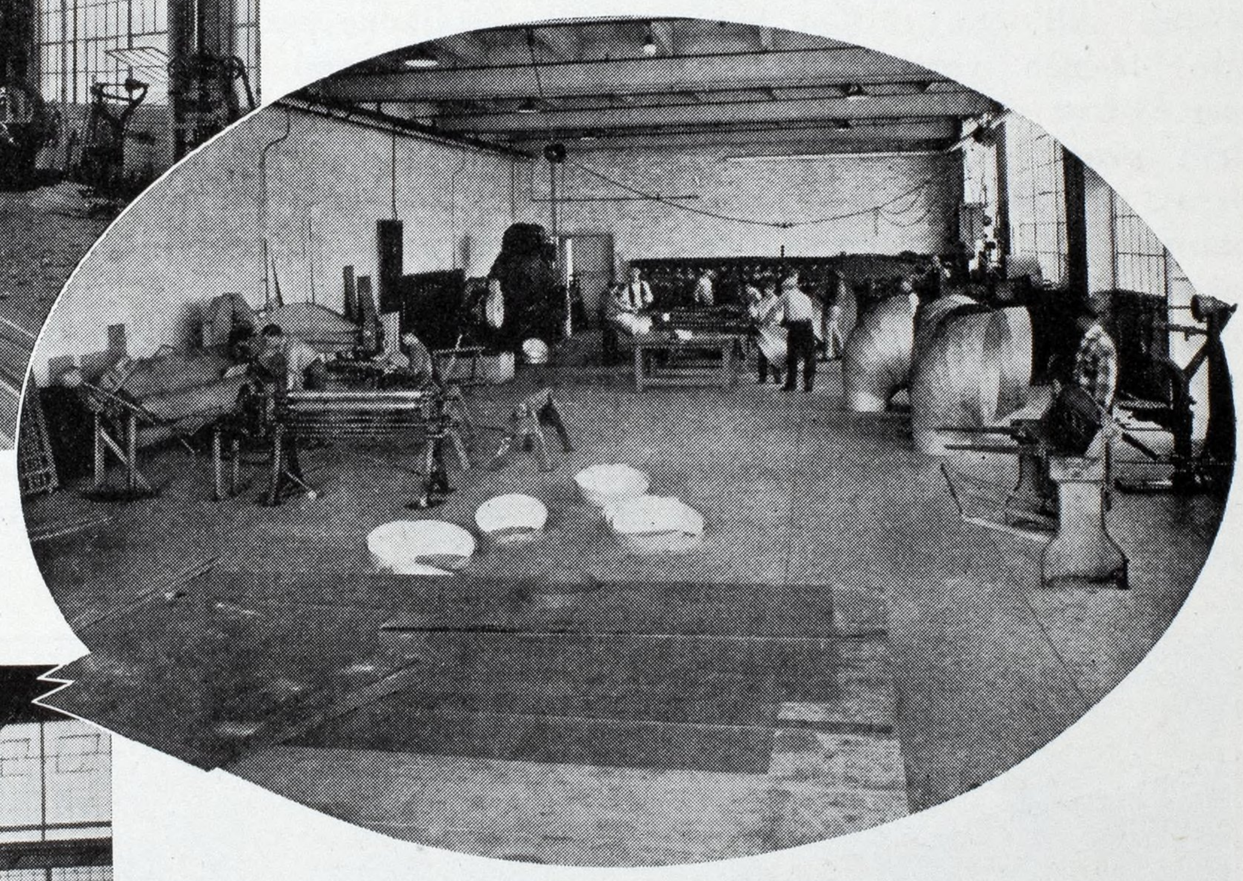
Above—Completely Equipped Pattern Shop with Latest Wood Working Machinery

Below—General View of the Machine Shop Fully Equipped for Ship Machinery Repairs

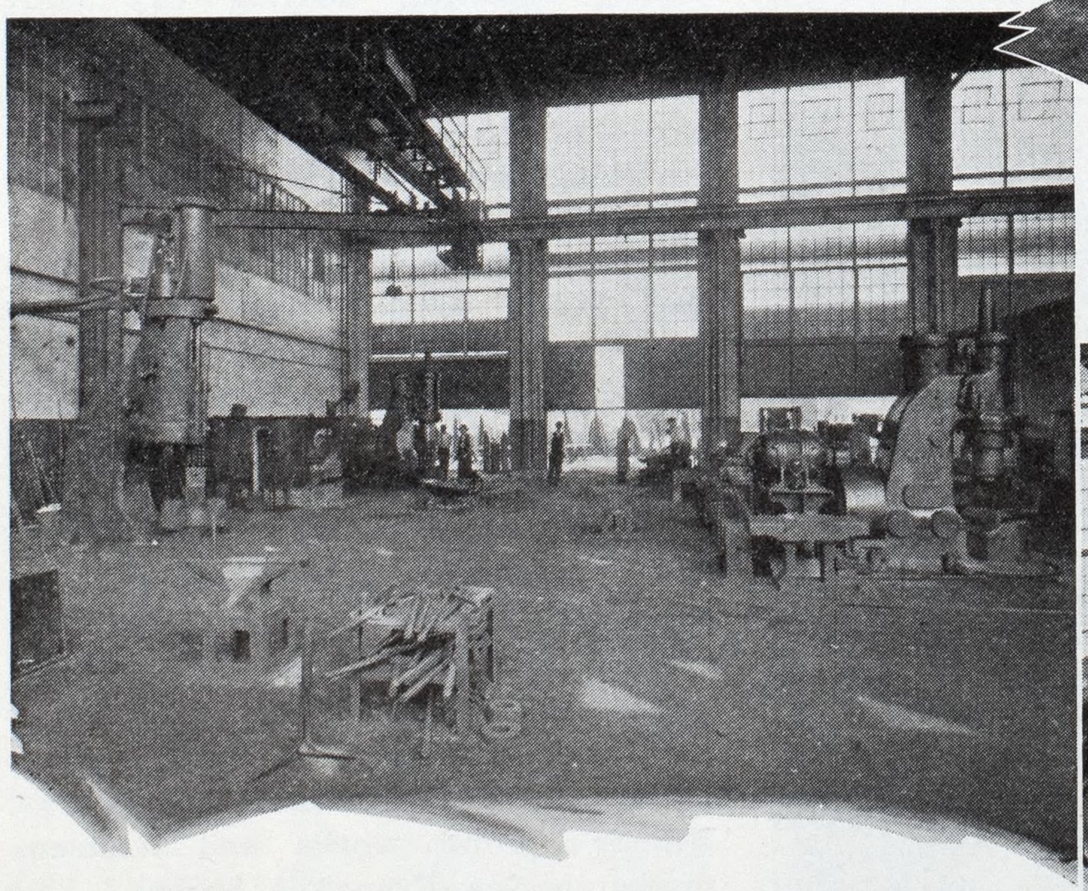


Above—Joiner Shop

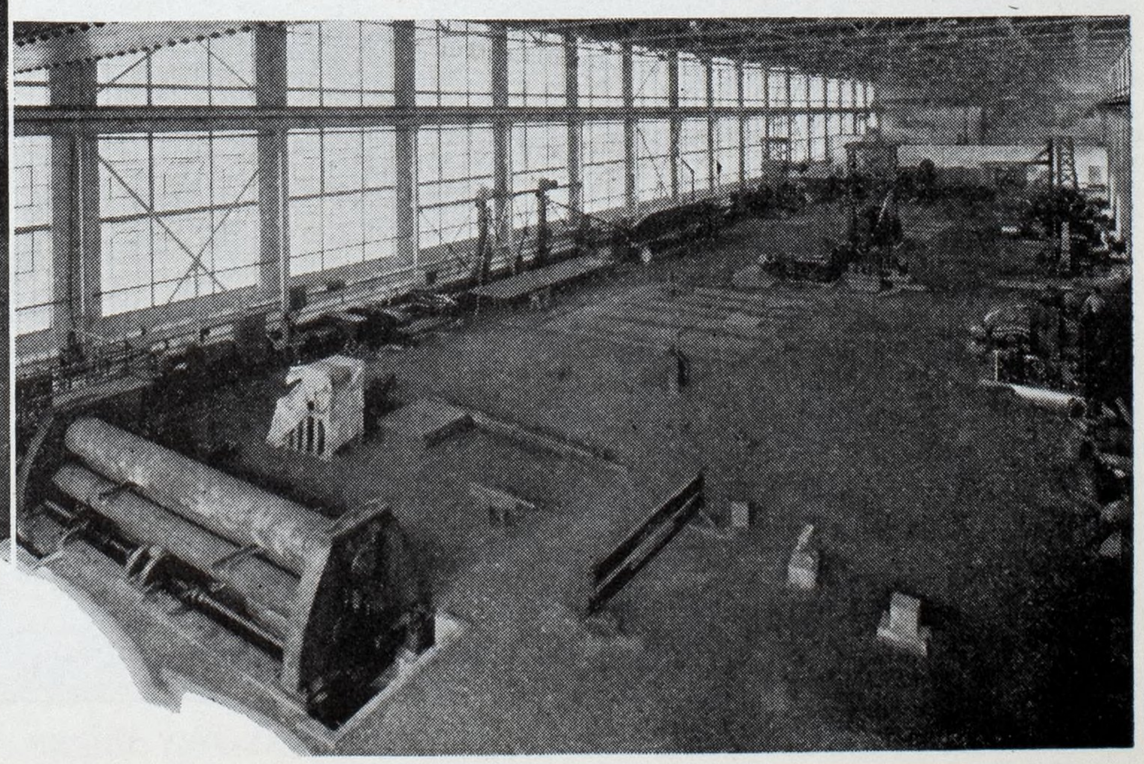
Below—Sheet Metal Shop

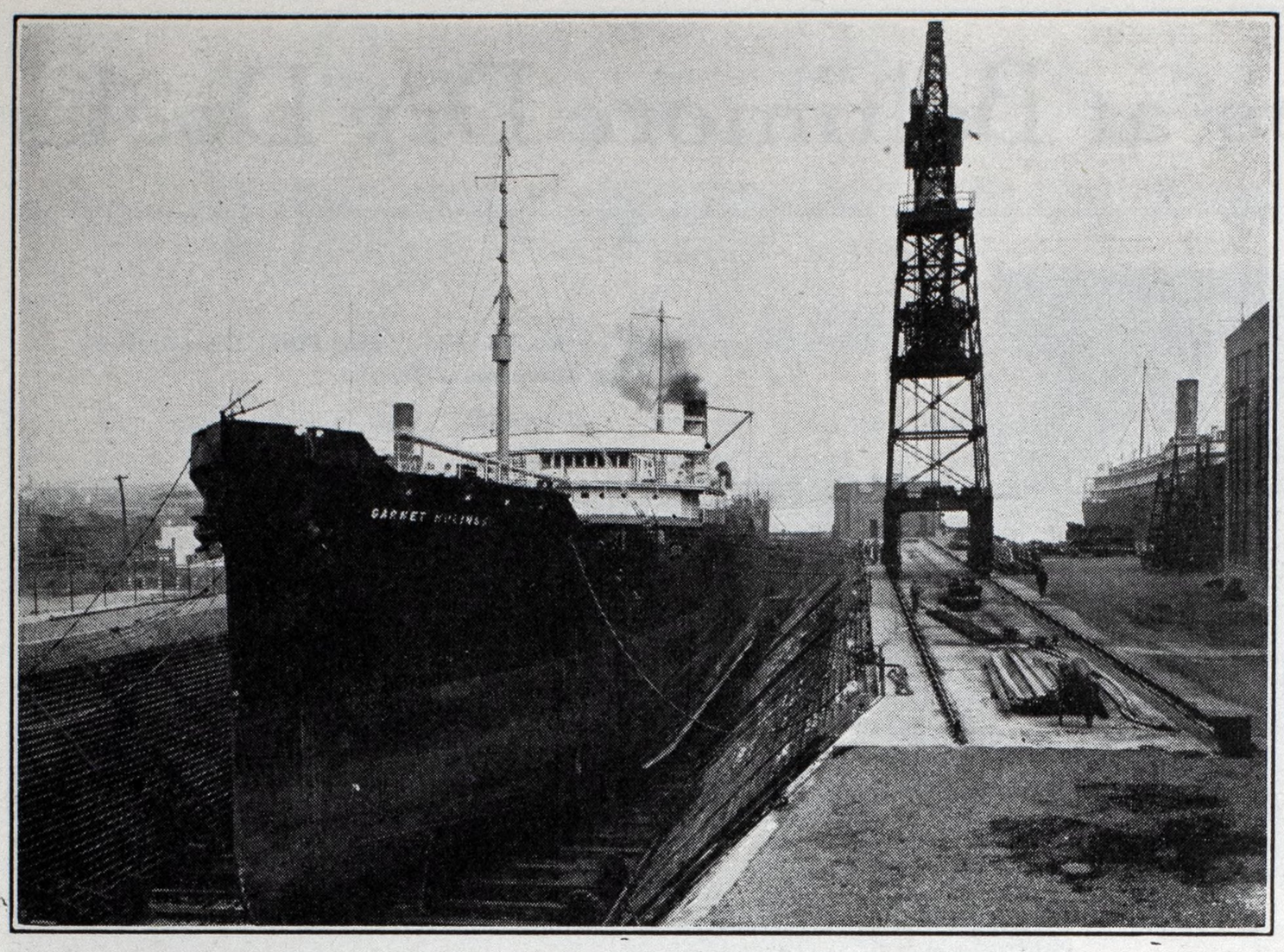


Below—General View of Fabricating Shop



Above—General View of Blacksmith Shop Fitted to Take Care of All Types of Forgings Necessary for Ship Repair Work



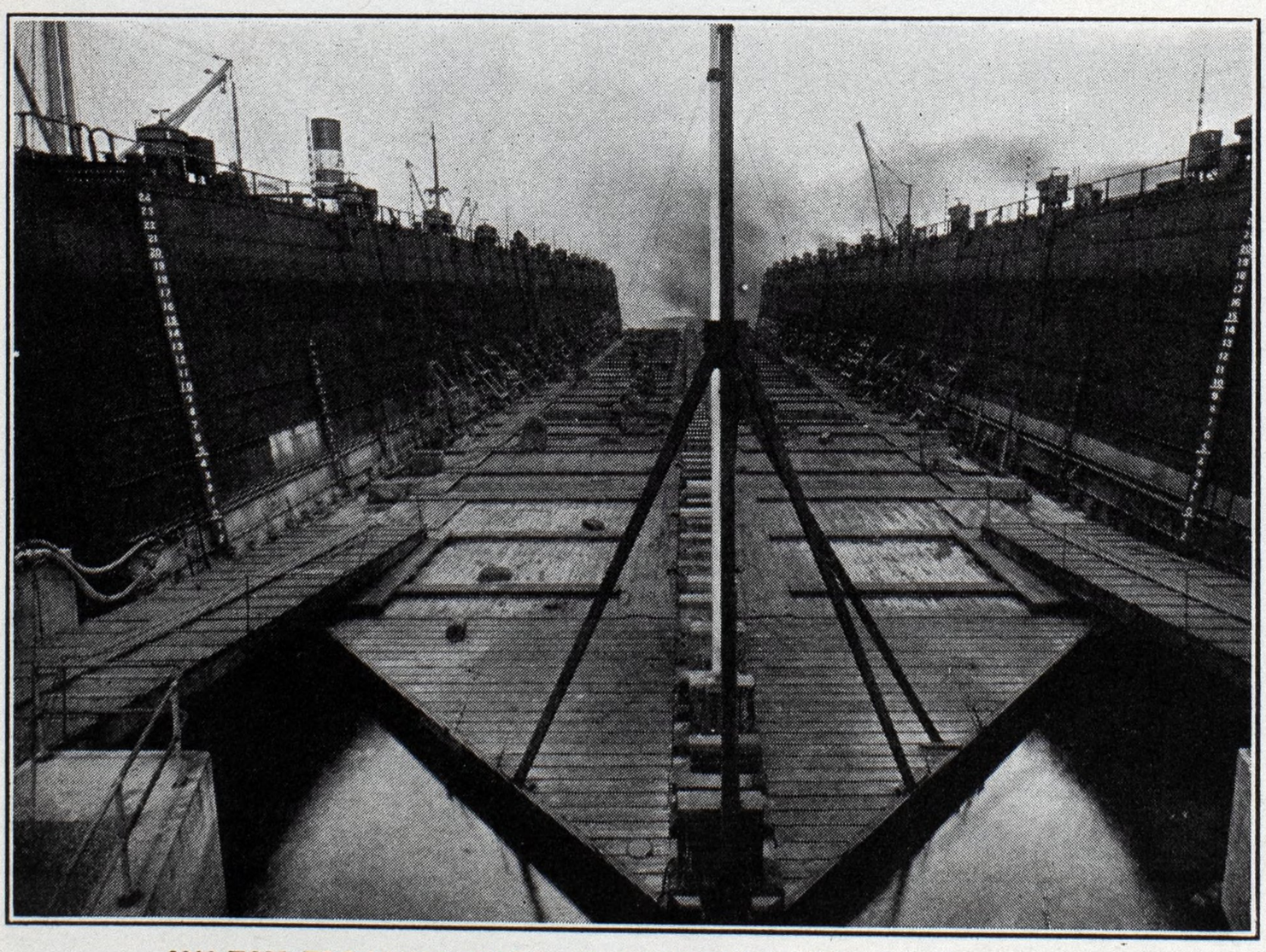


GRAVING DOCK AT BALTIMORE DRY DOCKS PLANT

toolmaker and electric repair shops are located. This second floor extends over a very small part of the entire length of the machine shop. Here the equipment includes such items as one 4½-inch post mill, one 60-inch boring mill, one 10-foot boring mill, two 44-inch vertical turret lathes, one 18-foot slotter, one 60-inch radial drill press, one 72-inch radial drill press, one 60-inch planer, one 36-inch planer, one 60-inch lathe, two 36-inch lathes, one 30-inch lathe, one 300-ton hydraulic press, two horizontal boring mills, two 24-inch shapers, two turret lathes, one milling machine, two 25-inch lathes, three 18-inch lathes, three 21-inch lathes and drill press, tool grinders, key seaters, bolt cutters.

Sometimes known as punch shop, the fabricating shop is one of the largest units and occupies nearly one-half the available floor space. In this are located: Two large capacity double punches, equipped with Lysholm tables; one plate jogger machine (bevel edge); and additional equipment.

In the electric repair shop the working force can tear out and rebuild motors and do any repair work of electrical nature on board ship. Ample facilities in the way of special equipment, as listed below, are available: One 24-inch x 10-foot lathe, one 16-inch x 6-foot lathe, one 30-inch drill press, one square shear, one coil winder, one coil spreader, one tapping machine, one baking oven.



6000-TON FLOATING DOCK AT BALTIMORE DRY DOCKS PLANT

An important feature of the shops mentioned so far is the overhead crane equipment, which is so complete that handling of material by the men is reduced to a minimum. This includes, in the brass foundry, one 2-ton crane; copper and brass shop, one 1-ton crane; machine shop, one 15-ton crane, and pipe shop, one 1-ton crane.

The sheet metal shop is located in the extreme end of the south leg of the S. This shop is fully equipped with breaks, punches, gate shear, drill presses, etc., to do any kind of work on plain and galvanized sheet metal.

The second floor of this building is divided about half and half between the joiner shop and the pattern shop.

Outside machinists are equipped for and capable of taking care of any kind of repair work on diesel or reciprocating engines, turbines, wheel jobs. Ample rigger facilities are provided.

One of the important adjuncts to repair facilities of this plant is the repair barge which is the largest floating ship repair shop in the Port of Baltimore. It contains a blacksmith forge, drill press, lathe, shaper, two pipe cutting and threading machines, emery wheel, two generators and two air compressors.

The docking facilities available for taking care of vessels that come in for repair work and overhauling are as follows:

1—A graving dock, large enough to take care of vessels having a length of 580 feet, beam 60 feet and draft 22½ feet. This is located between piers No. 1 and 2 and is served by tower crane, having a maximum lifting capacity at long boom of 15 tons. The pump house for this dock is located on pier 2 and the dock can be emptied in 90 minutes.

2—A 6000-ton floating dry dock having a mean low water depth of 37 feet. This is located between piers No. 4 and 5 and is served by a 15-ton (long boom capacity) tower crane, located on pier No. 5.

The completion of the Baltimore Dry Docks works gives Bethlehem three unusually well equipped plants on the East Coast. The other two are (a) the Boston plant, consisting of the former Atlantic works and the Simpson Dry Dock plant, located in East Boston, Mass., which have been thoroughly modernized in much the same way as the Baltimore Dry Docks works, and (b) the Fore River plant.

On the Pacific Coast the Union plant, includes the Portrero works, Hunter's Point works and Alameda works in San Francisco harbor. The San Pedro works in Los Angeles harbor, is equally well equipped to handle any and all classes of ship repair work, as well as new construction.

Marine Business Statistics Condensed

Record of Traffic at Principal American Ports for Past Year

New York

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
October, 1929	564	2,591,207	561	2,561,403
September	577	2,642,897	567	2,548,764
August	584	2,537,306	626	2,775,730
July	580	2,648,419	588	2,582,929
June	575	2,511,671	582	2,582,929
May	605	2,612,925	640	2,782,012
April	**626**	**2,677,963**	**606**	**2,547,409**
March	576	2,428,002	599	2,587,030
February	534	2,345,973	550	2,391,154
January, 1929	528	2,416,692	543	2,385,658

Baltimore

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
October, 1929	138	450,603	146	463,723
September	117	374,893	108	355,532
August	141	444,315	150	466,464
July	160	499,292	158	485,913
June	135	430,355	134	427,138
May	155	478,043	155	465,843
April	**158**	**471,851**	**156**	**465,710**
March,	131	401,217	138	426,539
February	127	397,147	132	410,667
January, 1929	126	386,102	122	372,302

New Orleans

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
October, 1929	244	681,983	261	713,490
September	257	684,203	260	698,665
August	272	726,363	273	721,024
July	279	712,324	288	741,716
June	277	708,089	273	711,898
May	289	758,671	277	717,581
April	**294**	**751,444**	**278**	**708,155**
March	283	773,515	298	517,632
February	248	682,052	249	675,432
January, 1929	273	710,969	282	744,078

Philadelphia

(Including Chester, Wilmington and the whole Philadelphia port district)
(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
October, 1929	99	262,305	62	154,401
September	107	282,105	61	145,895
August	110	271,857	54	120,595
July	120	321,726	70	188,269
June	97	254,811	61	140,065
May	126	343,548	75	191,192
April	**118**	**318,240**	**76**	**194,158**
March	117	309,233	81	203,080
February	98	263,790	56	163,324
January, 1929	86	243,505	63	187,612

Norfolk and Newport News

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
October, 1929	32	87,466	79	209,997
September	27	67,040	74	189,010
August	32	86,983	95	256,104
July	32	74,562	97	220,215
June	23	39,983	78	160,520
May	29	80,599	89	228,221
April	20	54,399	73	215,664
March	22	55,442	84	217,780
February	20	55,902	58	155,238
January, 1929	18	36,737	61	154,970

Charleston

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net. tonnage	—Clearances— No. ships	Net tonnage
April, 1929	24	62,976	26	62,467
March	14	37,470	18	46,087
February	26	78,237	26	66,648
January	23	54,709	25	57,589
December	20	46,569	17	43,041
November	22	56,983	22	50,043
October	24	59,136	26	61,673
September	21	60,956	22	54,537
August	24	62,574	26	63,874
July, 1928	26	59,204	27	61,976

Boston

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
October, 1929	95	310,386	56	196,590
September	139	387,061	106	265,839
August	139	387,061	106	265,839
July	151	376,620	109	327,487
June	135	309,662	103	268,270
May	139	343,990	113	286,147
April	125	328,493	87	221,533
March,	90	305,532	59	209,077
February,	96	289,629	58	196,264
January, 1929	94	294,036	47	164,132

Jacksonville

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
October, 1929	12	20,268	8	19,134
September	17	36,618	13	23,731
August	18	45,422	10	15,617
July	12	21,338	12	22,111
June	14	21,699	16	35,889
May	12	24,974	12	26,010
April	15	33,734	13	27,662
March	20	25,950	16	21,897
February	17	27,851	9	13,422
January, 1929	16	19,754	14	28,046

Galveston

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
October, 1929	36	88,056	118	385,367
September	47	131,512	101	323,955
August	37	87,502	74	275,017
July	36	72,793	87	259,450
June	35	75,614	78	243,391
May	37	79,121	79	220,456
April	36	82,330	93	294,062
March	33	62,486	77	221,143
February	37	96,127	81	256,077
January, 1929	45	133,396	106	347,297

Portland, Me.

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
October, 1929	25	54,402	25	56,022
September	30	58,497	30	64,559
August	32	59,299	31	58,111
July	31	55,932	31	53,761
June	29	49,060	28	47,961
May	24	39,080	25	39,830
April	20	45,922	21	48,999
March	15	36,185	15	38,415
February,	19	46,400	17	46,121
January, 1929	20	59,830	21	61,434

Key West

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
October, 1929	74	88,850	75	88,853
September	55	64,464	59	72,321
August	60	70,851	60	68,913
July	72	84,674	67	80,233
June	68	81,920	68	78,980
May	99	110,911	100	110,658
April	79	77,934	75	77,672
March	77	82,370	76	96,935
February	84	104,667	73	90,947
January, 1929	82	98,373	79	99,243

Los Angeles

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
September, 1929	259	621,704	225	605,808
August	204	583,568	185	554,520
July	203	705,042	169	620,250
June	186	574,459	159	582,247
May	167	604,274	224	597,519
April	**175**	**546,939**	**184**	**650,172**
March	177	572,573	180	523,807
February	150	470,851	157	484,043
January	193	581,357	191	536,504
December, 1928	199	551,301	154	487,064

Providence

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
October, 1929	6	20,741	8	32,974
September	9	38,226	5	23,339
August	6	24,438	6	25,315
July	12	38,408	9	29,585
June	11	40,920	7	31,040
May	11	39,061	5	18,506
April	5	20,267	5	17,898
March	5	19,121	5	21,902
February	2	5,891	4	17,323
January, 1929	7	24,095	4	17,289

Mobile

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
October, 1929	123	304,950	119	294,276
September, 1929	91	208,323	83	213,660
August	96	233,785	83	193,379
July	110	267,053	109	264,552
June	97	204,219	98	218,437
May	89	211,519	75	168,343
April	102	213,941	77	174,116
March	102	220,251	105	264,084
February	85	202,594	69	164,847
January, 1929	83	186,978	79	168,403

San Francisco

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
October, 1929	179	696,620	164	667,367
September	151	563,770	134	559,772
August	196	723,330	168	669,499
July	173	680,770	153	621,762
June	167	643,580	147	584,361
May	179	643,864	165	613,836
April	173	673,174	153	606,246
March	176	655,851	174	692,407
February	153	603,008	130	484,085
January, 1929	135	587,423	142	560,239

Portland, Oreg.

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
October, 1929	39	148,172	59	221,007
September	33	129,576	52	191,302
August	45	166,207	65	229,834
July	42	151,702	54	198,109
June	30	109,084	47	170,643
May	26	98,630	48	172,196
April	36	136,793	47	169,257
March	45	170,528	64	232,651
February	35	137,304	48	181,425
January, 1929	27	105,843	50	181,584

Seattle

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
October, 1929	72	293,569	68	277,041
September	46	203,192	47	203,236
August	62	258,910	63	263,569
July	64	259,303	62	252,021
June	48	199,237	56	233,867
May	51	216,463	53	221,564
April	62	264,744	61	254,647
March	57	234,394	59	248,901
February	53	222,462	55	225,789
January, 1929	60	242,464	73	290,077

Port Arthur

(Including Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
May, 1929	22	76,344	26	87,941
April	21	79,267	23	81,991
March	25	76,152	27	81,778
February	16	53,310	21	68,705
January	22	68,758	24	76,496
December	21	65,710	14	43,776
November	23	71,313	23	69,425
October	19	58,857	19	58,686
September	22	73,785	24	79,696
August, 1928	25	78,765	23	72,389

Note: The figures given in this table are for direct entrances and clearances. Additional vessels in foreign trade enter and clear from and to other American ports after original entry and before final departure. At the port of Philadelphia, for instance, additional vessels in the foreign trade in this category were 54 of 184,355 net tons entered and 73 of 236,732 net tons cleared for the month of October.

Late Decisions in Maritime Law

Legal Tips for Shipowners and Officers

Specially Compiled for Marine Review
By Harry Bowne Skillman
Attorney at Law

A STEAMSHIP striking a barge during a fog was held at fault, in the case of JOHN M. WORTH, 30 F. (2d) 238 because she had failed to perceive that she was running into a dense fog, failed to blow fog signals as required by inland rules, ignored the rule requiring her to reduce her speed before, as well as after, entering the fog, failed to moderate her speed or stop her engines until the alarm was given by the tug towing the barge, and failed to have a vigilant lookout. The tug was also held to be negligent, because she sounded no fog signals. Blowing an alarm does not excuse the tug from signaling as required when she is in a fog, declared the court.

* * *

THE owner of a barge who, with knowledge that it is moored in an exposed position, leaves it unattended with notice of an impending storm, is liable for injuries resulting when the barge breaks its lines and goes adrift. —D. L. & W. No. 442, 30. D. (2d) 250.

* * *

CONTRIBUTION in general average is required, where the ownership of goods is established in a respondent, and, on tender at destination of the sound goods which have been saved, delivery is accepted; that a certificate and not a policy of insurance was tendered was of no importance.—Johnson & Higgins v. Charles F. Garrigues Co., 30 F. (2d) 251.

* * *

WHERE a bill of lading exempts carrier from liability due to breakage and leakage, the shipper has the burden of showing affirmatively that the damage to the goods shipped was due to the carrier's negligence.—MATILDE PIERCE, 29 F. (2d) 794.

* * *

THERE is an implied warranty of seaworthiness as to a tank barge chartered to transport gasoline in bulk, or other petroleum products, and if the barge was not fit to carry the cargo mentioned in the charter party, she was unseaworthy, according to the decision in the case of LAWRENCE J. TOMLINSON, 29 F. (2d) 797. In this case it was further declared that as the barge in question was not a common carrier, her owner could by contract limit her liability.

* * *

THE collision which gave rise to libelant's claim against the CALORIC (decision reported in 29 F. (2d) 849), occurred in the Panuco river, near Tampico, in Mexico. From the facts stated it appears that the steamship CATHWOOD proceeded in a narrow channel of the river with undiminished speed, after refusal of the CALORIC leaving dock to assent to the passing signal, and that the steamship was without a licensed pilot and was in charge of an inexperienced master, who had never before attempted to take a vessel to sea through such channel. The court held that the steamship was guilty of improper navigation and solely at fault in the resulting collision by reason of the necessity of reversing the engines and anchoring.

* * *

A MASTER is a seaman as described in the federal law relating to suits by seamen without the prepayment of or bond for costs. Accordingly, it was held in the case of BURNS BROS. No. 31, 29 F. (2d) 855, that a master of a tug having a scow in tow, who, on landing the scow, went aboard her to inspect the damage, if any, that she had received from collision with another vessel while in tow of the tug, and was injured by the breaking of a ladder, was employed in the business of the scow, and could bring action against the scow without giving a stipulation for costs.

* * *

THE case of WEST NOHNO, 27 F. (2d) 950, is authority for the statement that the managing agent of a United States ship is not liable on any theory of agency for the careless navigation thereof at the time of a collision by a compulsory pilot, for whose selection such agent was not responsible, in the absence of any fault in the execution of the pilot's orders by the crew or assisting tugs; liability arises only in rem against the ship. Nor is there any liability to indemnify the owner against the consequences of the pilot's fault, unless by agreement the agent has assumed such liability.

* * *

AS REGARDS the recovery of demurrage, it was said in the case of Ashcraft-Wilkinson Co. v. United States, 29 F. (2d) 961, that it was the duty of consignee to assign a proper berth to the vessel and to receive the cargo as tendered; that, on the other hand, it was the duty of the ship to make use of the capacity and facilities of the wharf and to discharge and tender the cargo at the rate stipulated; and that the ship was responsible for any deficiency of her equipment and any insufficiency or incompetence of stevedores, and was in fault where it did not make full use of the facilities of the wharf.

* * *

CHARTERS are generally couched in technical language, but are to be construed reasonably, so as to give effect to the intent of the parties.—Cureton Lumber Co. v. Hammond Lumber Co., 29 F. (2d) 973.

* * *

TO RENDER available an exemption in a contract of carriage from absolute warranty of seaworthiness, the burden of proving the exercise of due diligence rests upon the shipowner, said the court in the case of Navigazione Libera Triestina v. Garcia & Maggini Co., 30 F. (2d) 62; and it is not sufficient that the shipowner employ competent men to make the inspection. He is held accountable for the failure of the man he employs to discover patent defects.

* * *

IN ADMIRALTY, the general principle is that claims of the same nature against a vessel separated by an appreciable interval are paid in the inverse order of their dates; the later liens really benefiting the older, and the older by delay holding the vessel out to the later lienors as worthy of credit. In the case of ANNETTE ROLPH, 30 F. (2d) 191, it appeared that the claims in question were all of the same class, and that four of the claims dated from 1921, one from 1924, and five from 1925. The general principle was applied, because no special circumstances were shown which would lead to the declaration of an exception. "Where such exceptions exist, as on the Great Lakes, in New York harbor, and in Puget sound," said the court, "they are based on the peculiar necessities of local shipping."

* * *

THE proprietors of a dock are bound to know the condition of the berth in which they place vessels; and the fact that a barge lying at a dock was a trespasser did not make her an outlaw, and the proprietor cannot be said to owe no duty to her, unless he did not know of her presence.—CHANCELLOR, 30 F. (2d) 227.

* * *

WHERE the United States widened and lengthened a slip between its pier and that of manufacturing company by using and submerging its own land, and the strip which it acquired from such manufacturing company, and the old slip formed part of the navigable waters, it thereby subjected the widened slip to public navigation; and as an abutting owner on such widened slip, the manufacturing company has the same right which every landowner abutting on navigable waters has, namely, free access thereto, and a consequent right to moor vessels to the bulkhead built on its own land.—United States v. Pennsylvania Salt Manufacturing Co., 3-F. (2d) 332.

Lubrication for Diesel Engines

Effect of Moisture in Compressors—Deposits—Proper Oil—Bearing Lubrication — Results of Oil Breakdown — Oil Characteristics

Part II

COMPRESSOR troubles arising from moisture are found in the final stages. The rush of wet Lubrication Air Compressor Cylinders high pressure air into the tube-like cylinder for final compression has a severe washing effect upon the lubricating oil film, interfering also with film removal, so that during compression it is difficult to maintain effective seals between piston rings and cylinder wall. Lack of a complete film results in blowby and excessive wear, especially toward the end of the compression stroke when pressure behind piston rings is greatest. Moreover, moisture and air cause rusting of valves, piston rings and cylinder walls —a condition frequently noticed by operators during inspection of high pressure cylinders. This rust formation causes pitting of valves; it also forms a grinding compound between piston rings and cylinder walls, which results in additional wear.

For these reasons, it is advisable to use an oil which, notwithstanding excessive moisture, will adhere to cylinder walls and valves, and supply a complete film that will prevent rust during idle periods.

Formation of Deposits

The formation of deposits is the most usual difficulty encountered in the operation of multi-stage high pressure air compressors. The most common causes are the use of too much lubricating oil, the use of unsuitable oil, improper distribution of oil between the several stages, excess due to the throw of bearing oil from moving parts, and impurities in the intake air.

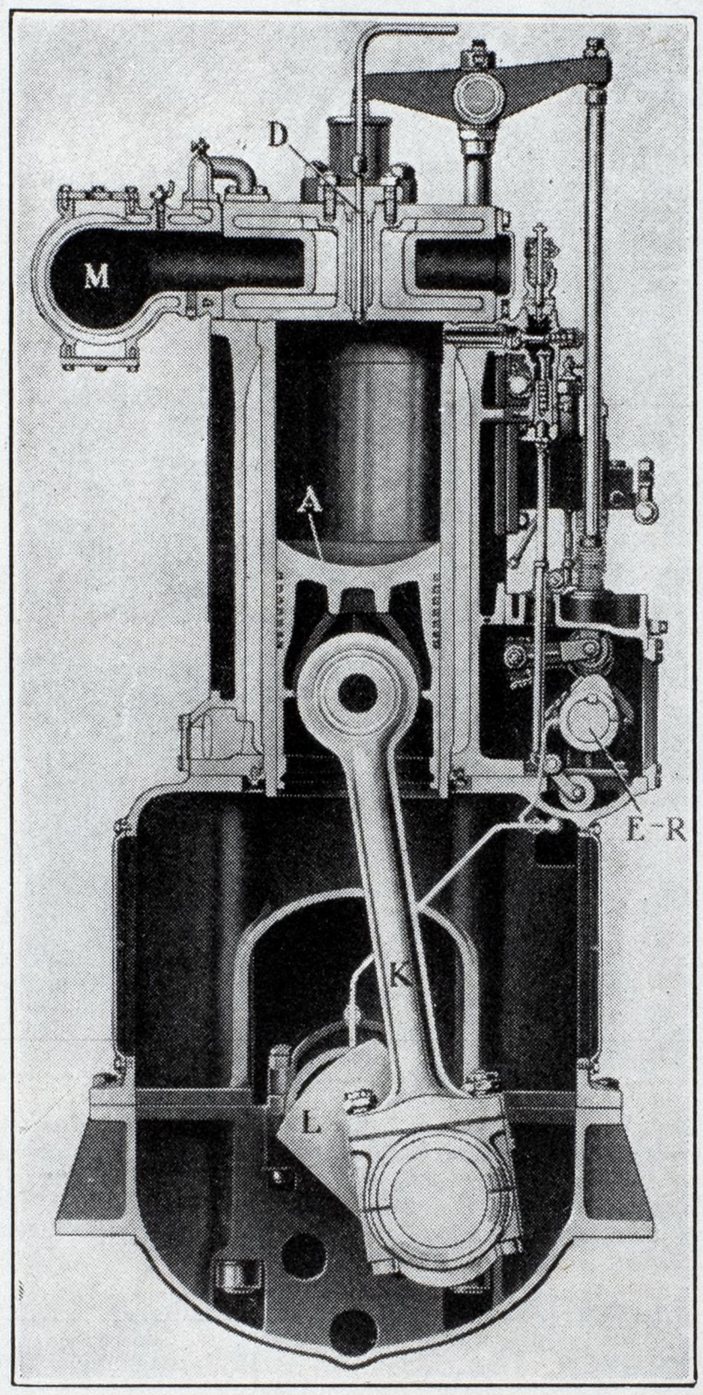
Air compressor cylinders require very little lubricating oil to provide and maintain a complete and efficient film. The correct feed for any given unit is determined by frequent examination when the engine is first installed.

Oils too heavy in body will deposit more carbon than oils of correct body, even though of the same high quality. Moreover, oils too heavy in body distribute very slowly and require excessive feed in order to assure the maintenance of a complete lubricating film. Since excessive feed breeds carbon in compressor cylinders, troubles are minimized, and explosions avoided, by a reduced feed of suitable oil, and not by the liberal use of very heavy oil.

This is the second and concluding installment of the authoritative article on lubrication for diesel engines prepared for MARINE REVIEW by the Technical Department of the Vacuum Oil Co. The first part appeared in the November issue.

Correct Oil for Compressors

To meet necessary requirements and to assure reliable, continuous operation, cylinder oil for diesel air compressors must possess exceptionally high lubricating value; it must provide film strength; it must resist wear and maintain efficient piston seal even though used in very small quantities; it should have moderate body and sufficient fluidity to give rapid and complete distribution; it should be of such a nature that any carbon formed will be soft, flaky, and easily removed, and will not interfere with valve operation; it must be able to resist washing effect even under most severe moisture conditions, thus assuring complete lubrication and preventing rust during periods when not in use.



Section through cylinder of trunk piston type Diesel engine showing method of lubrication

Where it is difficult to maintain correct injection-air pressure, this trouble has been traced to deposits on compressor valves which hold them open and greatly reduce volumetric efficiency. Generally this condition will be noted first by an increase of discharge temperature.

An additional cause of high discharge temperature is the accumulation of sludge and scale in water jackets. When this happens air discharge temperatures will rise, even though compressor valves are tight. Until this accumulation has been removed there can be no efficient cooling.

The cooling of air between stages results in the precipitation of considerable quantities of water in the intercoolers. If this water is allowed to accumulate for too long a period it will eventually be carried to succeeding compression stages where it will seriously affect lubrication. Frequent draining is necessary.

Even under favorable operating conditions, deposits will gradually accumulate in the inter- and after-coolers, and high pressure air line. The cleaning of these parts, at least annually, will often prevent future trouble.

How to Lubricate Bearings

In circulation oiling systems oil escapes from the ends of bearings and is whipped about the crankcase until it is broken up into fine spray. Contact of this spray with hot air in a crankcase is favorable to oxidation, especially in the presence of water and other impurities. Constant churning accelerates this oxidation, promotes emulsion, and altogether has a very detrimental effect on lubricating oil.

Depending upon design, impurities from other sources may place further serious burden on circulating oil. Leakage from water cooling systems, deposits from cylinder drip, dust from intake air, fuel—any or all of these may contaminate the oil in a crankcase.

Where pistons are oil cooled, part of the bearing oil circulating through the pistons comes into contact with the hot piston heads. Exposed to this high temperature, the oil must resist to the greatest extent any

tendency toward breakdown; otherwise the formation of deposits at this point will prevent effective cooling, and may produce excessive heat stresses that will even crack the pistons.

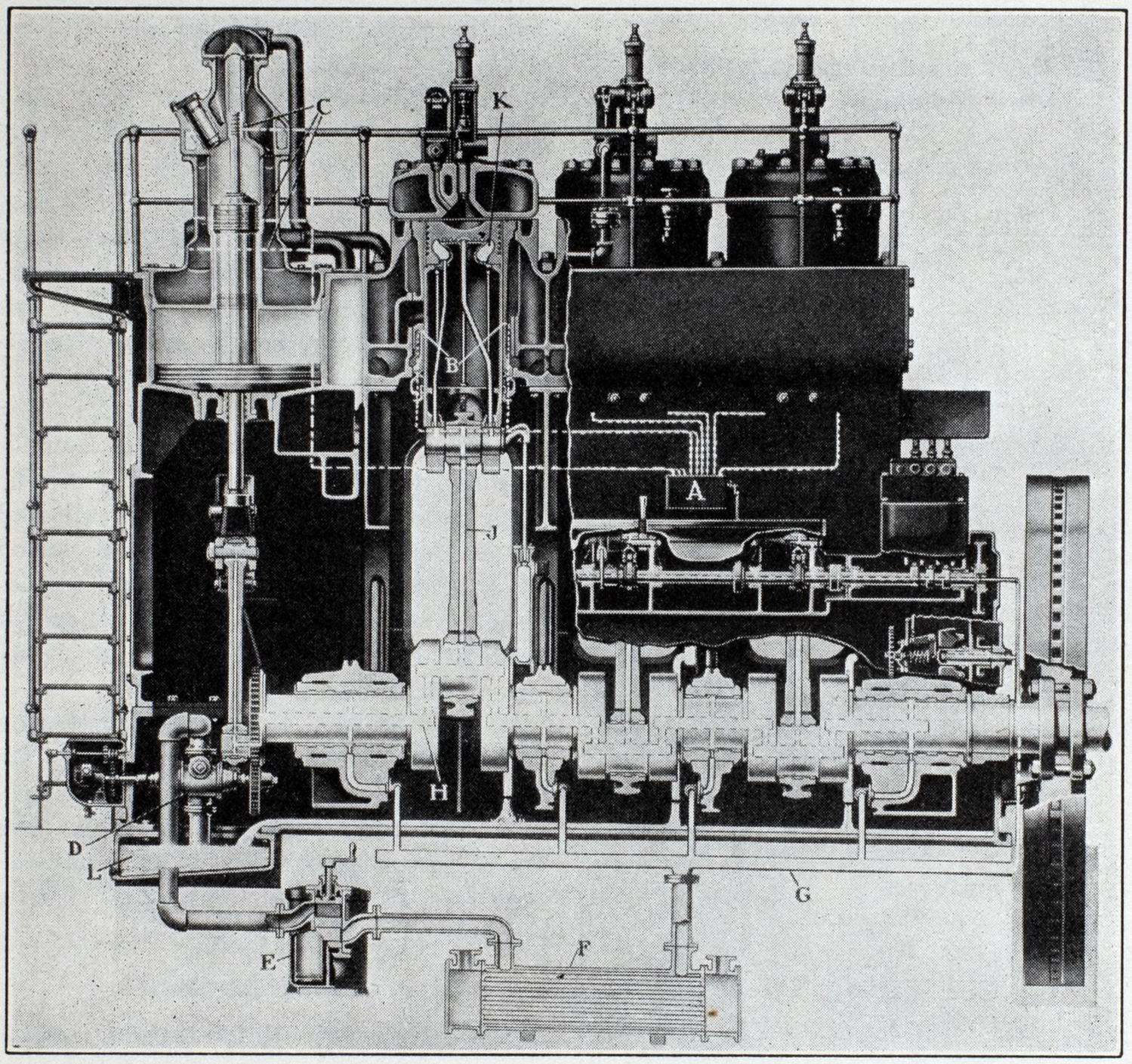
In order that bearing oils may resist these severe operating conditions, special care must be exercised in the selection of crudes, and equal care and skill used in their refinement.

Results of Oil Breakdown

Inferior or unsuitable bearing oils break down readily, and this condition manifests itself in the precipitation of gummy deposits. These may be present even when the oil appears to be in fairly good physical condition; but if they lodge within pipes or ducts leading to bearings, they become a source of imminent danger; their accumulation may not be noticed until restriction or stoppage of oil to some bearing or group of bearings results in serious consequences.

Formation of an oil wedge and maintenance of an oil film are affected also by the body or viscosity of lubricating oil. With too heavy an oil, not only is fluid friction abnormal and consequent bearing temperature excessive, but separation from inevitable impurities within an oiling system is made difficult. This lessens the life of the oil. When too light an oil is used, the film is not viscous enough to keep metal surfaces apart; rapid wear ensues, and sometimes burns out bearings. Moreover, too light an oil is readily atomized on escaping from the bearings, and the intimate contact of this spray with air is favorable to oxidation. Too light an oil often results in excessive consumption; but this depends to some extent also upon design, and operating conditions, and the opportunities for leakage.

Correct and economical bearing lubrication can be attained only through the use of oils having the following characteristics:



Lubrication System—Mechanical force feed to Power Cylinders and Air Compressor Cylinders and a Circulation System for Bearings. A—Mechanical Force Feed Lubricator. B—Lubricating line for Power Cylinders. C—Lubricating line for Compressor Cylinders. D—Oil Circulating Pump. E—Strainer. F—Cooler. G—Distributing Header. H—Crank shaft drilled for oil passage. J—Connecting rod drilled to carry oil for crosshead-pin Lubrication and Piston cooling. K—Oil-cooled Piston. L—Oil Sump

Characteristics of Bearing Oil

(a) Great film strength—a characteristic of certain oils which renders their film exceptionally cohesive, tenacious or tough, and resistant to rupture under heavy pressure.

(b) High chemical stability—an equally valuable characteristic, by which certain oils resist the destructive influence of continued circulation with solid and liquid impurities, and of agitation in the presence of air. This characteristic largely determines the durability of an oil and can be attained only in those high quality oils especially refined for this purpose.

(c) Ability to separate readily from solid impurities and water: it is this property which guards against the formation of sludge and emulsions, and which protects bearings from the inevitable destruction that occurs when such impurities, together with broken down products of unsuitable oils, clog the oil pipes and eventually shut off the oil supply.

(d) Correct body and fluidity—by which is assured the maintenance of effective lubricating oil films under the most severe operating conditions.

These characteristics are attained to a high degree only through the skillful selection of petroleum crudes, and through scientific planning and execution of refining processes, with the sole aim of developing these desirable properties to the highest possible degree.

Bearing lubrication, although important, does not present the problems encountered in cylinder lubrication. The principal considerations are the use of high grade oils capable of continued circulation, and the maintenance of their purity in service. It is not possible in the space alloted to this article to describe the various methods of purification employed.

In order to assure maximum life of oil and reliable lubrication, temperatures of oil to and from the bearings, and of water to and from the cooler, should be checked. Sudden changes, either of water or oil, indicate conditions which may be dangerous, and the cause should be immediately investigated.

All strainers in circulation systems should be inspected and cleaned at frequent intervals in order to prevent clogging and resultant restriction or stoppage of oil flow.

By the improved reliability attained on motorships, where engines and machinery are correctly lubricated, owners and operators have been able to keep their vessels in continuous service and hold to their schedule of sailing dates. Moreover, the quick "turnaround" that is possible when repairs have been minimized, together with the elimination of delays and reduced speed at sea, enable ships to increase their mileage under cargo.

Legal expenses payable by the British government in connection with the VESTRIS inquiry, according to a state ment made by the president of the board of trade in the House of Commons, ammounted to £7,115 8s, of which £2,698 10s was payable to the wreck commissioner who conducted the inquiry and £4,416 18s was paid to the three counsellors who represented the Board of Trade.

Latest Data on New Marine Work

Information on New Ships Ordered—Building and Repair Contracts Let—Shipping Board Loans Made, Authorized or Pending

IN A recent issue of the *Journal of Commerce* of New York it was stated that 48 new vessels are under consideration by fourteen different shipping companies. This new tonnage is being planned by companies who are expecting either ocean mail contracts or advances from a construction loan fund of the shipping board. Most of the vessels are of the combination passenger and cargo type. It is said that 40 of them are to be operated in foreign trade, six in the coastwise or intercoastal trade, and two in river service. This list does not include the fifteen or more tankers now on order, nor the thirteen passenger and cargo vessels ordered or under construction for overseas trade. New vessels under consideration according to company are as follows:

Shipping Company	No. of Ships
Grace line	1
Matson line	1
Dollar line	4
American Export line	2
American Scantic line	8
American South African line	1
United States lines	6
Eastern Steamship lines	3
Red D line	1
Panama Pacific Mail line	3
Panama Mail line	5
United Fruit Company	8
Colombian	3
Hudson River Night line	2
Total	48

This great construction activity exemplifies the great advances that are being made in the building up of the American merchant marine. Although at present no further details are available it is quite certain that the work will go forward as soon as the companies concerned are convinced of the advisability of operating additional vessels. In some cases the building of the ships is dependent on the granting of ocean mail contracts for the routes on which the new tonnage is to be operated.

McCormick Line Vessels

On November 18 the shipping board granted a loan of $5,625,000 to the McCormick Steamship Co. at San Francisco in aid of constructing six 13-knot cargo vessels. The loan was effected by Charles L. Wheeler, vice president and general manager of the McCormick company. It is estimated that each ship is to cost $1,250,000 and that the total cost of construction of the six vessels will be $7,500,000.

According to reports, the company intends asking bids for the construction at an early date so that the building may begin at once in order that the vessels may be completed by next year at which time they are to be placed in the line's service between the West coast of the United States and the East coast of South America.

United States Lines Bids

Bids for the construction of the new vessels for the United States lines were opened recently at the office of the lines, 45 Broadway. The three figures were not made public, the bids being placed in the hands of William L. Bunker, vice president in charge of operations, and William Perrott, manager of construction, for further study.

Bidders for the new work were the New York Shipbuilding Co. of Camden, N. J.; the Bethlehem Shipbuilding Corp. of New York, and the Newport News Shipbuilding and Dry Dock Co. of Newport News. The gross tonnage of the vessels will be about 30,000 and each ship will accommodate about 1300 passengers.

Construction of the ships, it was announced, would depend on the award of a transatlantic mail contract by the postoffice department and the granting of a loan under the terms of the merchant marine act of 1928.

To Receive Bids on Tug

Until December 4 the United States engineers at Philadelphia will receive bids in duplicate for furnishing all labor and material, performing all construction work and delivering one 50-foot motor driven steel tug. Plans and specifications may be seen at the engineers office and if copies of the plans are requested a deposit of $30 will be required but will be returned on submission of a bid or of the return of the plans and specifications.

Order Ohio River Boats

Contracts for the construction of three towboats, two for the Pittsburgh harbor and one for the Tennessee river have been received by the Howard Shipyards, Jeffersonville, Ind. The last mentioned craft is to be built for the Dixie Sand & Gravel Co. of Chattanooga, Tenn. while the other two are to be built for the Jones & Laughlin Steel Corp., Pittsburgh. The last of four super cargo barges building for the American Barge line is expected to be launched by the first of December. These four carriers have been specially constructed, electricity having been used in welding most of the plates and pipes. The first of the Jones & Laughlin Steel Corp. towboats is expected to be completed by June 1, 1930 and the second is to be delivered by Aug. 1.

Build Tankers for Lakes

Two diesel-electric tankers are to be built by the Bethlehem Shipbuilding Corp. of Quincy, Mass., at its Fore River plant, for the Lake Tankers Corp., a subsidiary of the Shell Oil Co., of St. Louis. Each tanker will have a length of 192 feet, a beam of 32 feet, a depth of about 12 feet and a draft of 9 feet. Each will have a capacity of 6000 barrels of oil and will be used for transporting petroleum products on the Great Lakes.

Complete equipment for electrifying the tankers will be supplied by the General Electric Co. The power plant in each case will consist of two Winton diesel engines direct connected to two 210-kilowatt generators rated 375 revolutions per minute, 250 volts, shunt wound, and two overhung exciters rated 20 kilowatts, 375 revolutions per minute, 125 volts, compound wound. The propeller of each boat will be driven by a double-unit, direct-current motor rated 500 horsepower, 200 revolutions per minute, 500 volts.

Gets Foreign Contract

The contract for the construction of a stern wheel towboat has been received by the James Lappan Mfg. Co., Pittsburgh. The new vessel is to be used in the transportation of bananas on one of the rivers in Mexico. The vessel is to be constructed and shipped in knocked down form to a port in Mexico by rail where it will be assembled. The Marine Mfg. & Supply Co., Pittsburgh received the contract for making the shaft, flanges and pillow block. The shaft which is to be of the hexagon type will be 15 feet in length and 6¼ inches in diameter.

Contract Awarded for Two Towboats

The war department, office of the chief of engineers received bids beginning Oct. 8 for the construction of two 90-foot deisel electric towboats which are to be equipped for electric propulsion. The bid of the Charles Ward Engineering works, Charleston, W. Va., has been accepted. The figure of this company was $190,750 for the two vessels. The boat is to be powered with a Lombard diesel engine and the electrical equipment is to be furnished by the General Electric Co., Schenectady. Other companies which are to furnish some of the equipment include Cummins-Worthington-Jennings who will supply the auxiliary compressor and pump with friction clutch; A. B. Sands Co., plumbing fixtures; Sharples, lubricating oil pump and separator; Hygeia Filter Co., water filter; Hyde Windlass Co., steering gear and motor with capstan and motor. Other companies include American Radiator Co., Webb, Ashcroft, Crane-Powell, Wallace & Tiernan, S. K. F. Industries, Link Belt and Davis Engineering. The bid accepted was the alternate No. 6. Bids by other companies were as follows: Nashville Bridge Co., $254,127, Marietta Mfg. Co., $210,550; Dravo Contracting Co., $216,240, the latter bids adjusted for time of delivery on the basis of $35 per day. The vessels are to be completed, the first in eleven months, and the second in 12 months.

Pacific Vessel Planned

The Wilmington Transportation Co. and the Santa Catalina Co. have under contemplation a vessel-building program which calls for expenditures estimated to be more than $3,500,000, according to a statement made by Joseph Patrick who is the western manager of the Wrigley interests. The plans are to be subject to the approval of William Wrigley, Jr.

Plans for the new vessel which is to be 350 feet long, 65 feet beam with accommodations for 3000 passengers are being drawn up by G. B. Newby and William Lambie. The cost of the proposed vessel has been estimated at between $1,350,000 and $1,500,000. The company is considering the use of diesel electric propelling machinery.

Loan for Conversion

The shipping board has granted to the American Tankers Corp. a loan which is to be used to aid in the conversion of the S S ULYSSES from a collier to an oil tanker. The amount of the loan is to be three-fourths of the cost of conversion and interest is to be payable at minimum rates provided for in the merchant marine act of 1928. Conversion of the ship is to take place at the Fore River plant of the Bethlehem Shipbuilding Corp. The vessel will have a capacity of about 100,000 barrels and is to be operated in the general oil transportation business.

New Ship Construction Loans Made

Name of Company	Number	Tonnage	Cost Each	Shipbuilding Company
American Export Lines.... (American Export S. S. Co.)	4	8,200 gr.	$2,300,000	New York Shipbuilding Co., Camden, N. J.
American Line S. S. Corp. (Panama-Pacific Line)	1	22,000 gr.	7,000,000	Newport News Shipbuilding & Dry Dock Co., Newport News, Va.
American South African Line	1	8,500 gr.	1,800,000	Sun Shipbuilding & Dry Dock Co., Chester, Pa.
Dollar Steamship Line	2	23,000 gr.	7,050,000	Newport News Shipbuilding & Dry Dock Co., Newport News, Va.
Grace S. S. Co. ..... (Grace Line)	1	9,000 gr.	3,273,000	New York Shipbuilding Co., Camden, N. J.
Motor Tankship Corp.....	5	13,450 dwt.	1,681,240	Sun Shipbuilding & Dry Dock Co., Chester, Pa.
Oceanic S. S. Co. ..... (Matson Line)	2	11,100 dwt.	7,800,000	Bethlehem Shipbuilding Co., Fore River, Mass.
Ward Line ..... (Atlantic, Gulf & West Indies S. S. Co.)	2	11,300 gr.	4,350,000	Newport News Shipbuilding & Dry Dock Co., Newport News, Va.

May Build Fast Freighter

On the Pacific coast there are reports that the Calmar line is planning the construction of four 14-knot diesel-driven freighters to be operated in the intercoastal service. Reports of this nature have been in circulation for the past year but as yet no actual steps have been taken toward beginning the construction.

The Robbins Drydock & Repair Co. has received contract for repairing the British steamer ATHELFOAM which was damaged Nov. 17 in a collision with the Ericson line steamer JOHN CADWALLADER. A hole was stove in the side of the ship at the time of the accident.

Export Line to Build Two More Ships

The Export Steamship Co. is contemplating construction of two additional liners in a building program which totals six vessels. Announcement of this fact was made by Henry Herberman, president of the line, upon the eve of laying the keel of the second vessel of four new sister ships to be operated in the New York-Mediterranean service. No further details as to the new ships are available at this time but it is very certain that the two additional vessels are to be constructed. It is believed however that the new ships are to be larger and faster than the four which have been contracted for with the New York Shipbuilding Co. of Camden, N. J.

The keel of the second vessel in the Export building program was laid at the New York Shipbuilding Co. yards on the morning of Nov. 12. The construction of the first of the vessels is going along rapidly and it is expected the ship will be in service the latter part of next year and that the last two vessels of the present program will be in service by the end of 1931.

The principal dimensions of the four new ships which were designed by Sharpe & McDonald are: Length 450 feet, beam molded 61 feet 6 inches, depth to shelter deck 52 feet 3 inches, and gross tonnage 8200. The new ships are to have luxurious accommodations for 100 first class passengers.

At present the Export line is the largest private owner of American tonnage operating in regular South Atlantic trades. The company owns a fleet of 24 vessels and operates 13 vessels for the shipping board. The six new ships which are building or contemplated will bring the fleet total up to 30 vessels.

A large sand and gravel company in Chicago which has been operating in the work on the Chicago waterfront has under consideration plans for converting one of the larger bulk freighters into a type of sand sucker similar to the craft which it now has in service. Operation of the company's present equipment has convinced them of the practical economy of this type of vessel.

Specifications and plans for the new vessel to be built by the Universal Portland Cement Co. and operated in the cement trade on the Great Lakes are going forward and it is expected will be completed in the near future.

To Recondition America

The United Dry Docks Inc. has been awarded the contract for reconditioning the liner AMERICA. The company's bid was for $223,665. The work of reconditioning which is to be carried out at the Morse plant, began Nov. 24 and will be completed by Jan. 12. The major item in the work will be installation of 48 new furnaces in the boiler room. General repairing where needed will be done throughout the vessel.

According to department of commerce report, quite a number of orders for new ships are being placed for the Norwegian merchant marine.

To Construct New Liner

According to announcements made through the Montreal office of the Holland American line, plans have been made for the construction of a new 33,000-gross-ton liner. The new vessel according to reports is to be built by Harland & Wolff at Belfast and is to be delivered in 1931.

Announces Plans for Two New Liners

PLANS have been made public by the Oceanic Steamship Co., Matson line, for the two new express and mail liners to be built for the San Francisco-Sydney service, via Honolulu, Pago Pago and Suva. They will be built under the provisions of the Jones-White act of 1928, conforming to the rules and regulations of the American bureau of shipping and the United States steamboat inspection service, as well as the proposed rules recommended by the International Conference on Safety of Life at Sea, adopted at a meeting in London the early part of 1929. The Bethlehem Shipbuilding Corp. is constructing the ships, which are to be delivered in February and June of 1932.

The general particulars are as follows:

Length overall	632 ft. 0 in.
Length between perpendiculars	605 ft. 0 in.
Beam	79 ft. 0 in.
Depth to D Deck	44 ft. 6 in.
Draft	28 ft. 0 in.
Displacement at 28 feet draft, tons	25,885
Guaranteed trial trip speed, knots	20½

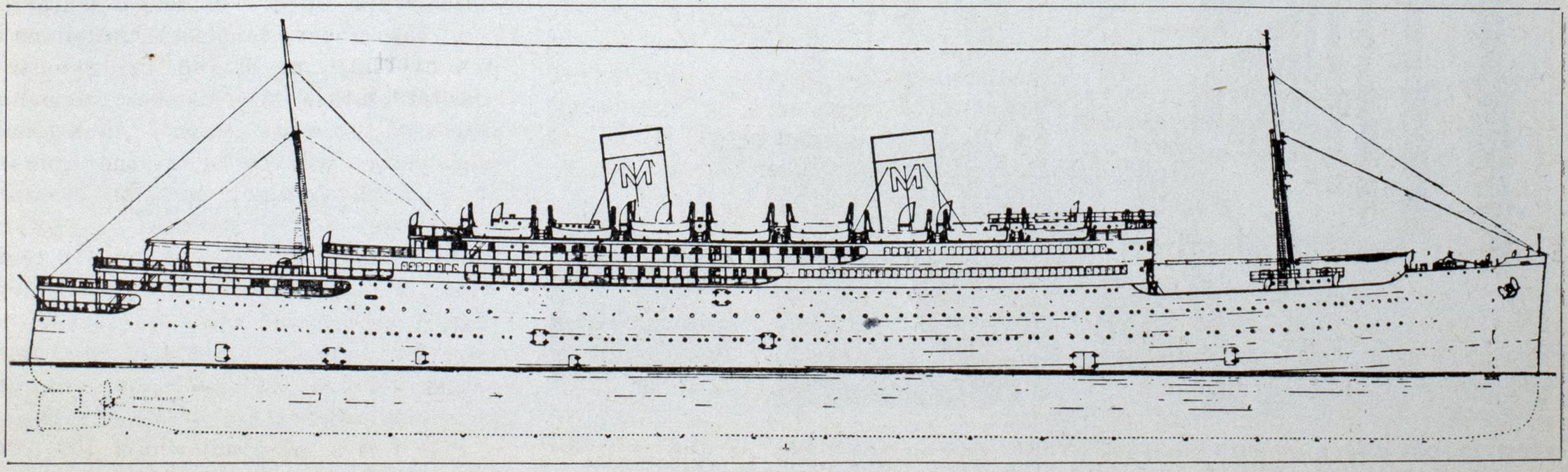
There will be nine decks, 16 watertight compartments with double bottom throughout, cruiser stern and rake stem. The bulkheading arrangement is such that with two of the largest adjacent compartments of the vessel flooded the vessel will be perfectly safe at sea, and in fact, as safe as the Matson liner MALOLO, which condition was demonstrated at the time of a collision while the vessel was proceeding on her trial trip in August, 1927, off the Jersey coast.

Accommodations have been provided for 620 first class passengers, 572 of which number will be accommodated in beds and day beds. There will be accommodations for 217 tourist class, 137 of which number will be accommodated in beds. Cargo space will accommodate 5000 tons of dry cargo and 1000 tons refrigerated cargo in six chambers. Anyone of the six chambers can be used as a freezer.

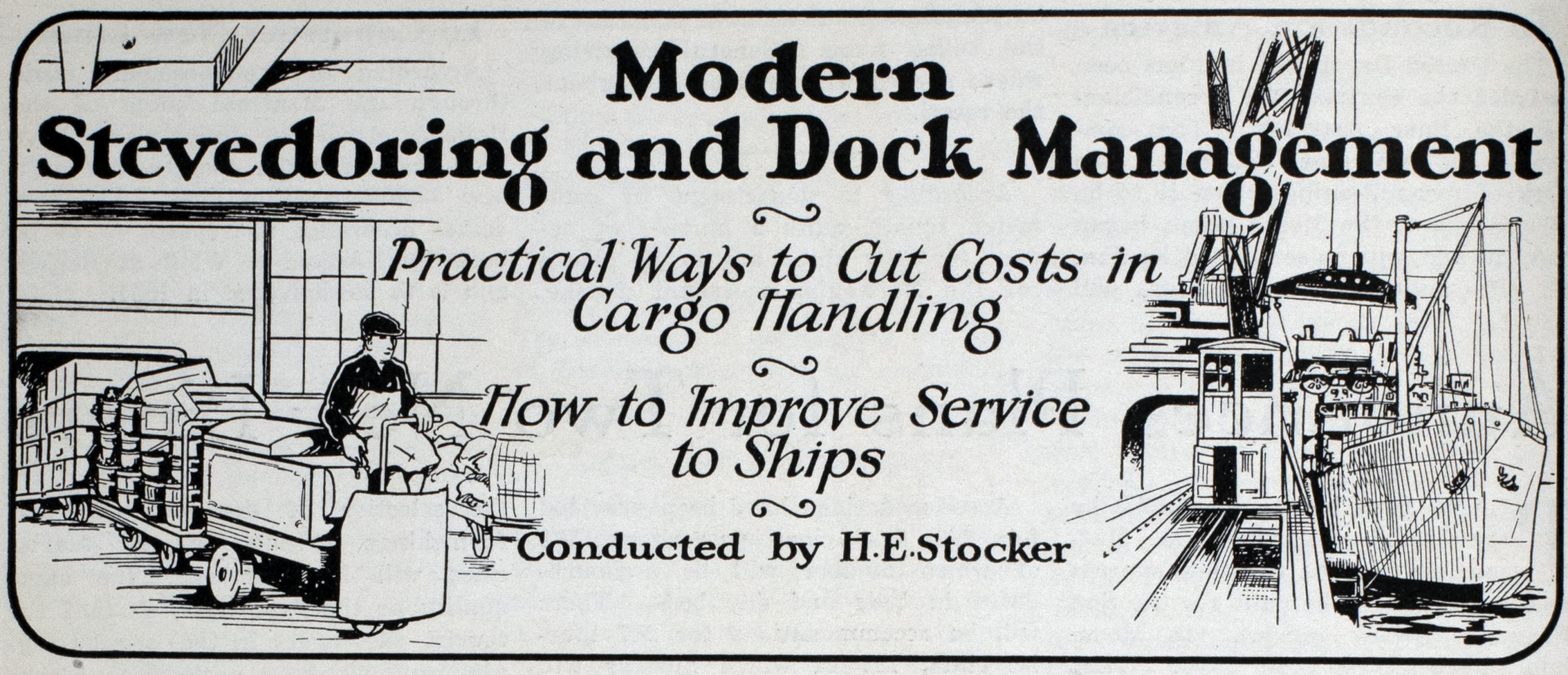
Mention should be made of some of the special features in the design of the new vessels which are for the comfort of the passengers. There will be two electrically operated passenger elevators serving all decks for the first class passengers, and an extra large baggage room easily accessible from the passenger elevators with a baggage elevator for careful handling of passenger trunks in and out of the ship. The ventilation for the entire ship will be of the "Thermo-tank" system, arranged for the circulation of either natural or heated air with the cooled air supplied for the dining saloons mentioned previously. The dining saloons will be specially insulated to further insure comfortable atmosphere going through the tropics.

A complete telephone system will be installed throughout the ship, and each and every first class and tourist class stateroom will be provided with a private telephone. For the purpose of converting the ship to first class in case of special trips or cruises, the selection of the furniture and furnishings throughout the tourist class will be practically the same quality as the first class, so that the tourist passengers in the vessel's regular run will have probably a higher class accommodation than other services now provide. A very complete broadcasting system will be provided so that public addresses and music from the orchestra can be transmitted to several of the public rooms in the first and tourist class spaces; also in connection with the broadcasting system, radio reception from shore will be transmitted over the system. A specially constructed moving picture booth will be arranged and a complete equipment provided to show the talking pictures. The talking pictures will be supplied separately for both class passenger spaces.

All of the latest fire protection systems and the finest life saving equipment available will be used in the construction of the vessels. The watertight doors below the passenger accommodations will all be operated by individual watertight motors located at each door and all doors will be controlled from the pilot house. The vessel will be propelled by twin propellers and the main propelling machinery will consist of three turbines and a set of single reduction gears on each shaft. The normal shaft horsepower is 22,000 with a maximum of 25,000 shaft horsepower.



LINE DRAWING OF 26,000-TON EXPRESS AND MAIL LINERS TO BE BUILT BY THE OCEANIC STEAMSHIP CO., MATSON LINE



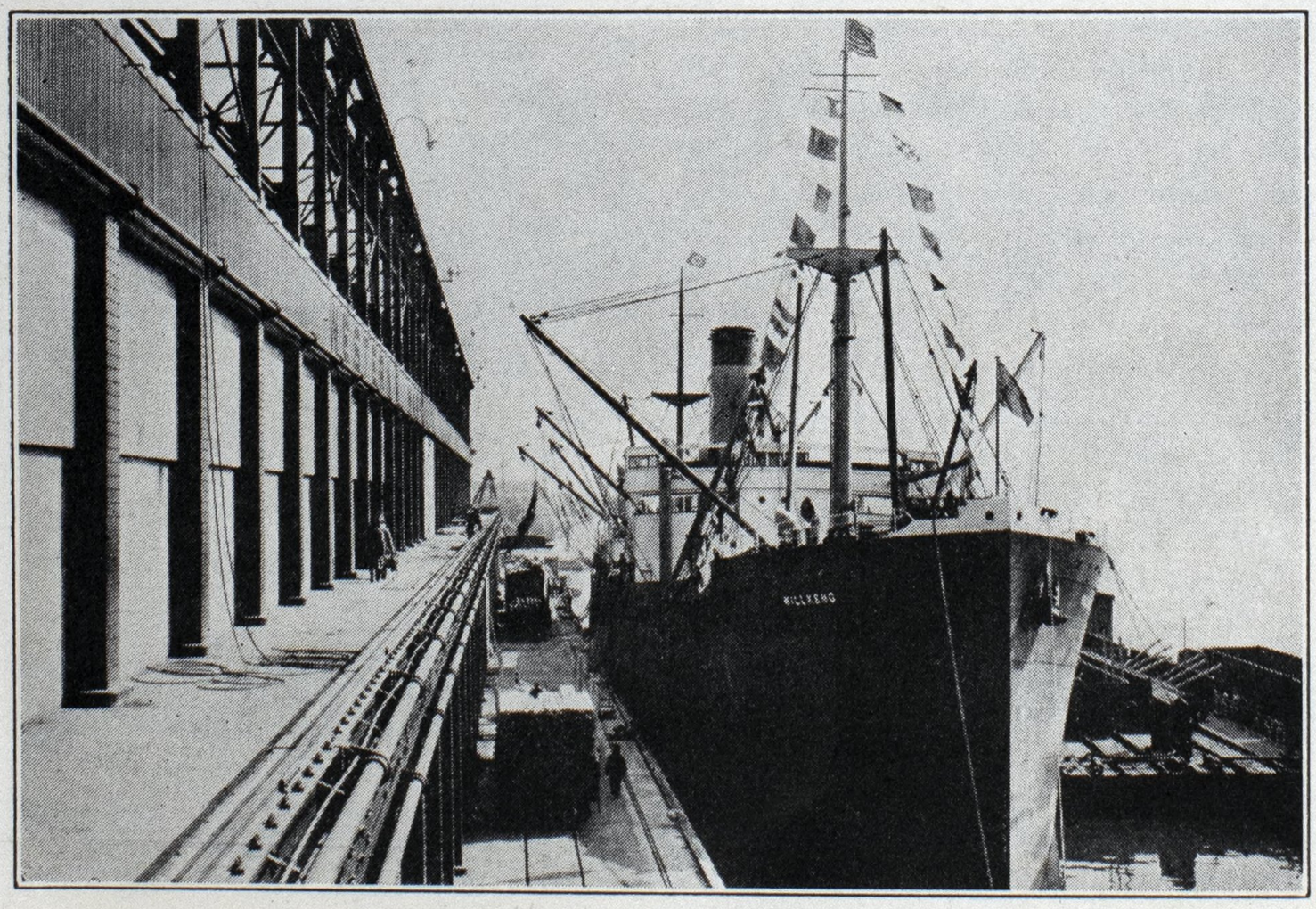
New Ocean Terminal at Baltimore Handles Cargo Economically

By H. E. Stocker

THE new McComas street ocean terminal of the Western Maryland Railway Co. at Baltimore is exceptional. Every aid to handling cargo economically and to turning ships around quickly has been provided.

It is evident that the men responsible for the design of this terminal did not overlook, as others too often have, that the principal purpose of a terminal is the economical handling of cargo and the quick dispatch of ships. The McComas street terminal is located next to the present facilities of the Western Maryland railway at Port Covington, on the Patapsco river branch of Baltimore harbor. The terminal is eight minutes by automobile from the center of the business district of the city.

A thirty-five foot channel, 200 feet wide (the government is now dredging to 400 feet) has been dredged from the terminal to the main Baltimore ship channel at Fort McHenry. The terminal area comprises 60 acres of which 38 acres are water area dredged to 35 feet at mean low water. The area under the roof is thirteen and three quarter acres. The floor space totals 900,000 square feet. There will be storage capacity for 120,000 tons of freight after deducting for driveways, aisles and obstructions. Thirty-eight hundred and twenty feet berthing space is provided so that seven large ships may be docked at one time. There are 5 miles of trackage on the docks and in the yards and 28,000 square yards of paved driveway areas.



VIEW ALONG PIER 9 OF THE McCOMAS STREET OCEAN TERMINAL AT PORT COVINGTON, BALTIMORE—WHERE RAIL AND SHIP MEET UNDER IDEAL CONDITIONS FOR TRANSFER OF FREIGHT

The facilities consist of piers 7, 8 and 9 and warehouse A. Pier 9 is 935 feet long by 135 feet wide and is provided with a two-story transit shed, one surface shipside track and two depressed tracks at the inshore side of the shed. In addition there is a two-story warehouse parallel with pier 7 which is served by two depressed tracks. As business warrants increased storage space, additional warehouses will be built in the rear of pier 9, parallel to the present warehouse.

Pier 8 is 1000 feet long by 216 feet wide. It is provided with a two-story transit shed, two depressed tracks in the shed and two surface shipside tracks on the east side and one on the west side.

Pier 7 is a marginal wharf 700 feet long by 90 feet wide with a two-

story transit shed and has two depressed tracks at the inshore side of the shed and two surface shipside tracks.

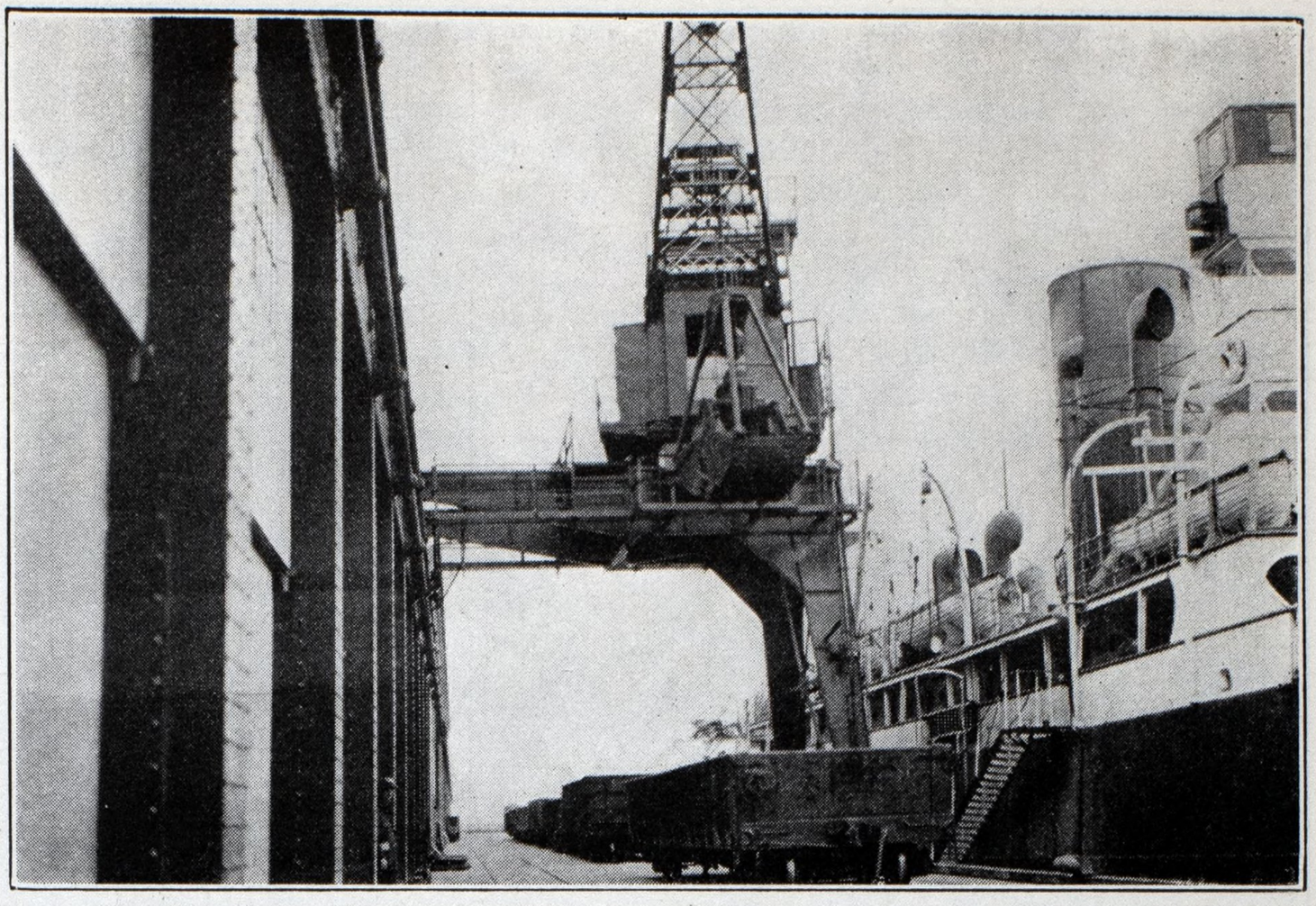
The proper provision of depressed and surface tracks permits working cargo with the maximum efficiency. At pier 7 and at the east side of pier 8 a cargo ship, fitted with long booms, may discharge lumber to cars on the outside track and when these are loaded, may shift to a string of cars on the second track without waiting for a switch engine to pull the string of cars next to the ship.

This results in a direct saving in stevedoring expense because the gangs are idle for much less time and the ships cargo is handled faster. Delay and excessive expense is also avoided by providing three sets of crossovers 550 and 600 feet apart for two tracks along the aprons of piers 7 and 8. This permits pulling a string of cars from alongside a ship at the upper end of the piers without disturbing the stevedore gangs working a ship at the inside berths. Each set of crossovers consists of a crossover from the inside track to the ship side track and one from the outside track to the inside track. These two crossovers intersect between the two main tracks.

Two sets of crossovers are also provided for the depressed tracks within the shed at pier 8.

All berths are equipped with cargo masts which permit the working of the inside apron tracks with short boom ships as well as the doubling up in the large hatches. There are three Wellman-Seaver-Morgan 10-ton semiportal electric cranes arranged so as to serve the seven berths. There is one on pier 9 and one on each side of pier 8. The crane on the east side of pier 8 also serves pier 7.

These cranes are provided for use in handling heavy lifts, or cargo too heavy for ship's gear, for doubling up on hatches and for loading and unloading barges and lighters, when the ship's gear is not available.



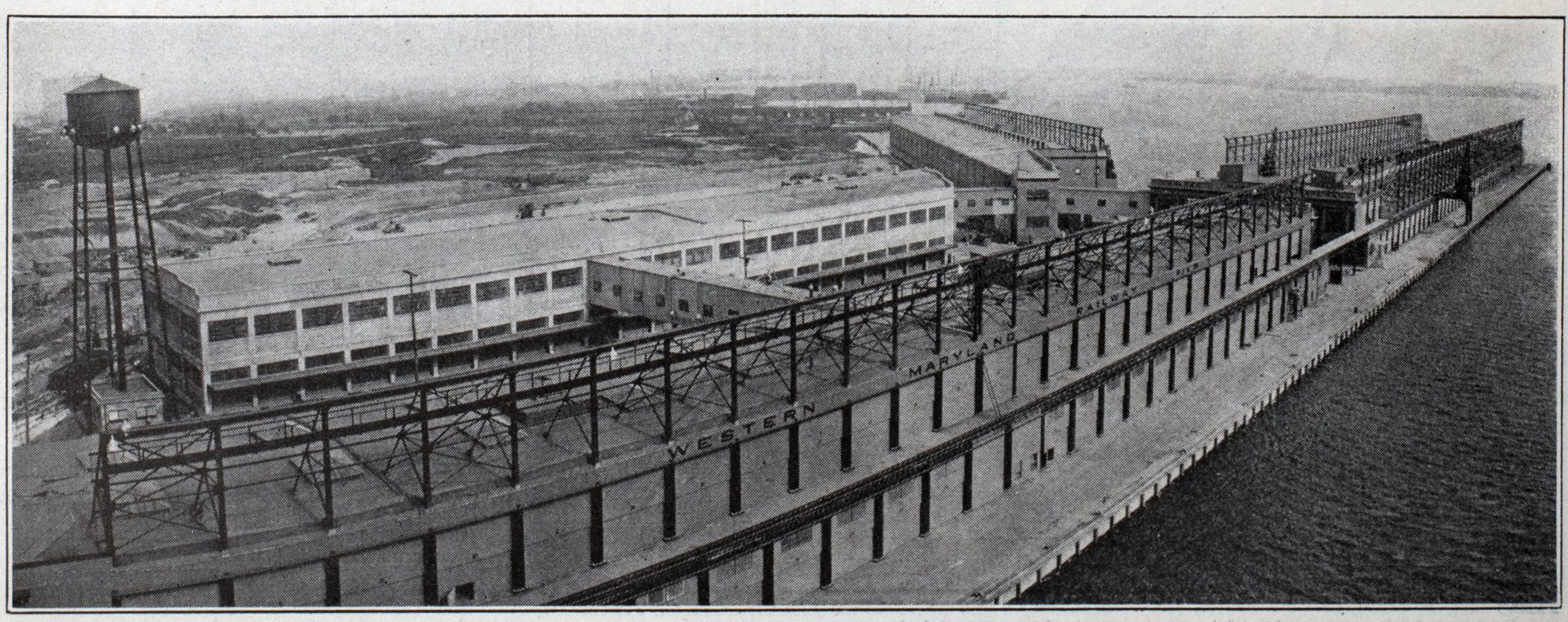
THE NEW McCOMAS STREET OCEAN TERMINAL AT PORT COVINGTON, BALTIMORE IS SERVED BY THREE SEMIPORTAL TYPE CRANES WITH REVOLVING AND LUFFING JIBS—LIFTING CAPACITY 20,000 POUNDS AT MAXIMUM RADIUS OF 41 FEET 4 INCHES. BUILT BY WELLMAN-SEAVER-MORGAN CO.

The revolving and luffing jibs have a lifting capacity at a maximum radius of 41 feet 4 inches of 20,000 pounds, or the crane may be reeved for a whip hoist handling 6000 pounds at a maximum radius of 46 feet 4 inches. They may also be utilized for handling bulk materials with clam shell buckets, the hoisting unit in the machinery house being equipped with double drums for this purpose.

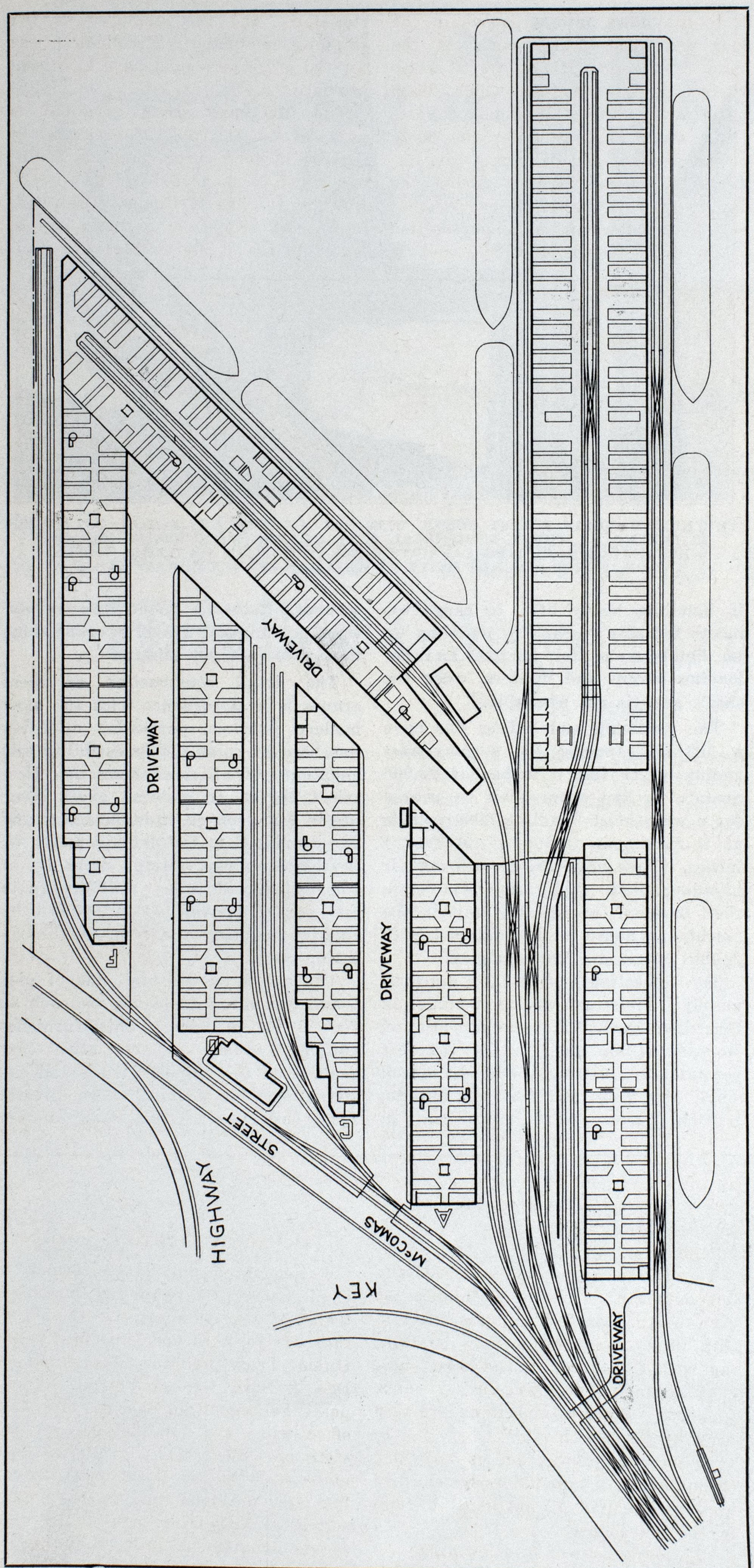
The operating speeds are approximately:—Hoisting—20,000 pounds on four line block 150 feet per minute, Hoisting—Clam shell bucket 150 feet per minute, Hoisting—6000 pounds on single line hook 300 feet per minute, Luffing boom, Total travel in 30 seconds, Rotating boom, two revolutions per minute, Travel of crane along dock, 300 feet per minute.

The detail construction of these cranes is in accordance with the most modern practice, particular attention has been given to the accessibility and simplicity of all mechanical and electrical parts. In general, gears operate in cast iron oil tight housings and are connected to the driving motor by flexible couplings. Motor gears are of the herringbone type. Stability up to 100 per cent overload is insured by counterweighting the rear of the rotating unit.

The apron on the east side of pier 7 and the apron on pier 8 are each 32 feet 6 inches wide. This furnishes sufficient space between the cars spotted on the shipside track and the stringpiece for working cargo directly from box cars to ships hold or vice



McCOMAS STREET OCEAN TERMINAL AT PORT COVINGTON, BALTIMORE. ERECTED BY THE CITY OF BALTIMORE FOR THE WESTERN MARYLAND RAILWAY CO. FORMALLY OPENED OCT. 19, 1929



FIRST FLOOR PLAN OF THE NEW McCOMAS STREET TERMINAL AT COVINGTON, BALTIMORE. THE SMALL BLOCKS INDICATE STORAGE SPACE FOR CARGO. WAREHOUSES HAVE SO FAR ONLY BEEN BUILT ON SPACE A IN THE TERMINAL YARD

versa. This saves the wasteful handling necessary when freight must be unloaded from box car to pier, and then taken from pier to shipside. The apron on the west side of pier 8 and the apron at pier 9 are 20 feet 6 inches wide, also providing ample space for working box cars.

There is a platform with an awning along the west or inshore side of pier 7 and also a platform with awning along the east side of the warehouse. This is to facilitate loading and unloading freight cars.

Handling cargo to and from the upper decks of the piers is aided by a platform ten feet six inches wide running along the outside of the second floor shed. This platform was provided by setting back the wall of the upper floor shed the width of the platform. This is shown in one of the illustrations.

Cargo is handled between the upper and lower floors of the piers and the warehouses by Otis elevators and by spiral chutes. Two 8000-pound capacity elevators and one of 20,000-pound capacity are provided on pier 7, three 8000-pound capacity and one of 20,000-pound capacity on pier 9, two of 20,000-pound capacity on pier 8 and three of 8000-pound capacity in the warehouse.

There are two spiral chutes of 5 feet 8 inches radius on pier 7, three on pier 9 and four in the warehouse. These were supplied by the Standard Conveyor Co. Each chute is provided with a portable platform on casters which locks to the bottom of the chute to provide a landing platform for cargo coming down from the upper floor.

Two cut gangways or ramps, 16 feet wide and 27 feet long, are provided at the end of pier 8 for working cargo to and from lighters.

The Western Maryland Railway Co. has equipped the terminal with six Baker-Raulang storage battery tractors and 200 trailers for loading and unloading cars and for transferring freight within the terminal. The tractors are of the three wheel short wheel base type, which make possible operating in restricted spaces in freight cars, on lighters and about the terminal. They are equipped with Mercury safety automatic couplers which facilitates the making and breaking up of trailer trains. Power is furnished by 42 cell Edison storage batteries.

The trailers, which are of standard dimensions, are equipped with Timken roller bearings, Mercury automatic couplers and Goodrich and Goodyear rubber tires.

An excellent charging room for the tractors has been provided. An Elec-

tric Products Co. motor generator set is used in conjunction with a Wotten panel.

Trucking throughout the terminal is facilitated by good floors and roadways. The floors are constructed of Hastings asphalt blocks. Sheet steel runways have been provided along both sides of the depressed tracks in the sheds to facilitate trucking.

Covered bridges connect the piers and the warehouse. The layout of the bridges shows well in one of the illustrations. Cargo may be moved over these bridges from one point in the terminal to another point in the terminal without damage in inclement weather. These bridges are strong enough to support a loaded ten-ton motor truck. Two movable bridges over the depressed tracks are provided on piers 8 and 9 to shorten trucking distances when it is necessary to cross to the other side of the pier. The bridges are raised and lowered by electric motors.

Docking of ships and handling of cargo is aided by the provision of Ogden turnover doors in every bay. The entire side of each shed is made up of doors so no difficulty is experienced in having a door opposite each hatch. A lip on the bottom of the doors fits down into a groove in the floor and keeps water out. At the front of the door there are a series of rectangular openings which drain water away. This arrangement prevents water beating under the doors in bad weather and damaging cargo.

The sheds are lighted during the day by two skylights in every other bay, by windows in the upper section of the doors on the first floor and by windows in the ends of the sheds.

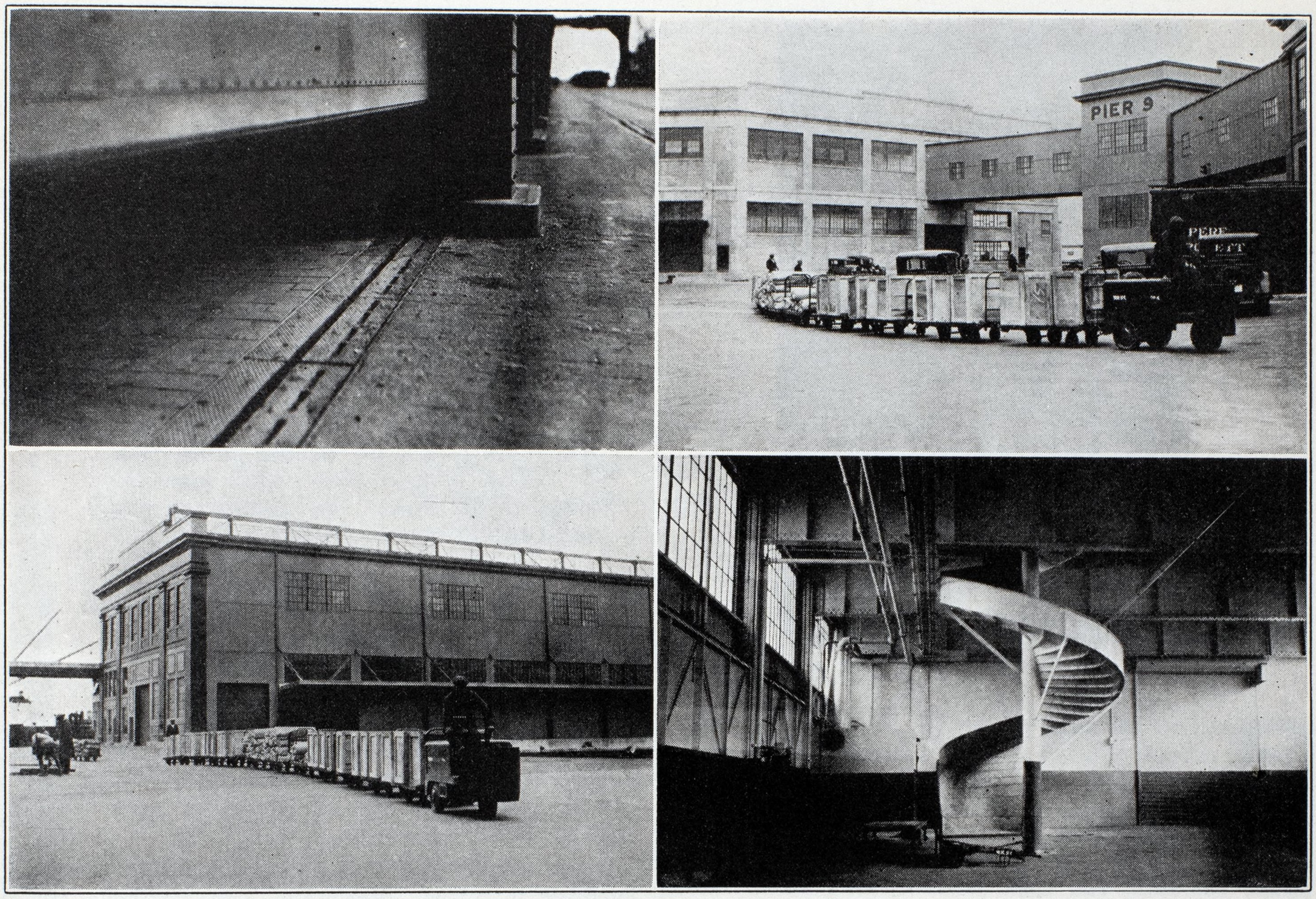
At night the terminal is well lighted by numerous electric lights. Flood lights were placed near the top of the cargo masts to furnish light for working ships at night.

Service to ships is increased by telephone outlets on the stringpiece at each berth. A few minutes after a ship docks the captain may be talking with the officer or the chief engineer arranging for necessary repairs, fuel, etc. Water connections are also provided at each berth.

Ample fire protection is provided throughout. A sprinkler system has been installed in all of the sheds and in the warehouse.

The designers of the terminal remembered Napoleon's maxim and constructed a commodious restaurant for the employes of the railroad, the stevedores and the employes of the shipping companies. Excellent offices for the office personnel have also been provided.

The McComas street terminal is part of a $50,000,000 program to further modern cargo handling facilities which is sponsored by the City of Baltimore. The McComas street terminal cost $8,500,000 to build and is leased to the Western Maryland Railway Co. for a period of thirty years, with privilege of renewal for 15 years if so desired.



VIEWS OF THE McCOMAS STREET OCEAN TERMINAL AT COVINGTON, BALTIMORE. UPPER LEFT—DOORS ARE FITTED WITH LIP TO PREVENT WATER BEING BLOWN INTO SHED AND DAMAGING CARGO. UPPER RIGHT AND LOWER LEFT—TRACTOR TRAILER TRAINS TRANSFERRING CARGO. LOWER RIGHT—SPIRAL CHUTE IN WAREHOUSE

To Open Branch Office

According to an announcement by Emil Lederer, director of passenger traffic of the Hamburg-American line, the company will open an office in the Union Trust building, Cleveland, on Dec. 2 with George Petroll, district passenger agent, in charge. The new office will have jurisdiction over the state of Ohio. Mr. Petroll has been affiliated with the Hamburg-American line for the past ten years, having served in various divisions of the passenger department until 1925 when he was sent abroad to study in the offices of the company in Germany, France and England.

Personal Sketches of Marine Men

Henry N. Fletcher, Manager Fletcher Plant, United Dry Docks Inc.

By B. K. Price

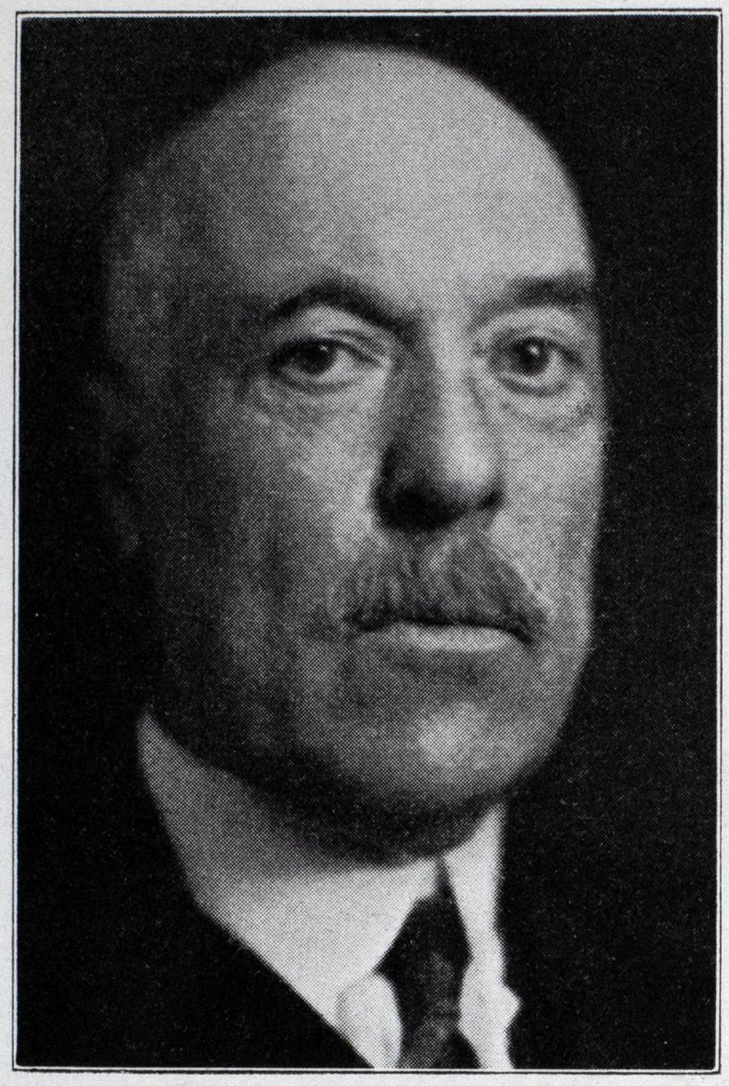


Photo by Blank & Stoller

THE name of Fletcher will always be associated with the building of the famous Hudson River and Long Island Sound steamers.

THESE vessels, many still in successful operation, are unique in their special fitness and excellence in engine and hull construction.

AS MANAGER of the old plant, now a large modern ship repair yard, he brings to his duties the experience and judgment of many years.

FACING the busy waterfront of one of the metropolitan district's largest shipyards, in Hoboken, is an office on the walls of which are mounted ship models and testimonials reflecting the achievements of three generations of ship and engine building men. The office, old in its comfortable appointments, but spick and span as a captain's cabin, fairly teems with the atmosphere of the marine industry. And here, most befittingly, is to be found on most any business day the genial, though dignified figure of Henry N. Fletcher.

Long prominent in the field and for more than 40 years identified with the Fletcher organization, now a subsidiary of United Dry Docks Inc., New York City, he not only is a shipbuilder, but the son of a shipbuilder and one of a large family of shipbuilders. His father, Andrew, and his uncle, William, were two of three founders of the original Fletcher, Harrison & Co., New York City, organized in 1853. Moreover, his brother and his cousin, the son of William, and later their sons, have all been identified with the shipbuilding industry and with the Fletcher company in particular.

Further background is provided by alluding briefly to the early stamp of the organization in the affairs of which he later was to assume so important a role. The original company was a marine engine building concern. Reputed to be the first builder of the beam engine, this organization made many famous installations before becoming a builder of steamships and before becoming engaged in general ship repair work.

The first installation was in the JAMES H. ELMORE in 1854. Then came a number of installations in river, Long Island Sound and coastwise vessels, including the renowned MARY POWELL in 1861. Two hundred and sixty feet long, 34-foot beam, 9-foot 6-inch draft, she was said to be the largest river steamer up to that time, and she traveled at the unprecedented speed for river craft of 22 miles per hour.

These installations were but forerunners of literally hundreds to follow. Meanwhile, came contracts for the construction of completed vessels. There were the famous old Fall River boats PURITAN, PRISCILLA and PLYMOUTH, each hailed as among the finest of her class. Later came the equally famous Hudson river group, including HENDRICK HUDSON, completed in 1906. This vessel, with a capacity of 5000 persons and a speed of 24 miles per hour, was regarded as the finest day line passenger steamship in existence until the Fletcher company built her still more modern sister ship, the WASHINGTON IRVING.

In 1906, the GOVERNOR COBB also was completed. This boat was famous because of the installation of the first Parsons marine steam turbine engines to be built in this country, with trials and ultimate tests proving most successful, and it may be added that to Andrew Fletcher Jr. fell much of the credit of this installation, for it was through exhaustive study of several months in England and Scotland that he was able to return to this country to supervise the construction and installation of these engines.

Then there were the YALE and HARVARD turbine steamers, now on the Pacific coast, and many others. The CORSAIR, built for J. Pierpont Morgan, is one of several famous steel steam yachts to have been constructed at the Fletcher yards. During the World war, these yards

established an enviable record in the conversion of merchant ships into transports.

Henry, affectionately known to the marine fraternity as Harry, was born in New York City in 1870. He left City College of New York in 1887 and in the following year became affiliated with the Fletcher organization, then known as the W. & A. Fletcher Co. It was incorporated under this name shortly after the death of William in 1883 and prior to that, from the time of the retirement of Joseph G. Harrison, one of the original incorporators, in 1880, was known as W. & A. Fletcher. Seven years after its incorporation—1890—the company was moved to Hoboken.

Following a fundamental training in various branches of the organization, Henry N. Fletcher devoted his attention chiefly to finance and business management. Upon the death of his father in 1905, he became secretary of the company. Incidentally, at this time his elder brother, Andrew, later head of the American Locomotive Co., became president and treasurer, and his cousin, William, vice president. Upon the latter's death in 1913, he became vice president, and Jay F. Whitaker became secretary.

When Andrew III came into the company in 1918, he became assistant to the president and the vice president, and upon the death of Mr. Whitaker became secretary, and just recently has become affiliated with the St. Joseph Lead Co. as vice president and treasurer.

Upon the absorption of the Fletcher yards by United Dry Docks Inc., which was formed early this year, Mr. Fletcher became manager of what is now known as the Fletcher plant, and Arthur, son of William H. Fletcher, who joined the company after serving in the World war, remains as his assistant.

Mr. Fletcher has contributed more than his share of constructive effort to the marine industry—he has contributed one of its finest personalities. Characterized as one of the few "without an enemy in the world," he has always displayed a kindly, helpful attitude to all with whom he has been associated.

While Mr. Fletcher resigned from numerous clubs and marine organizations several years ago, he remains a member of the Society of Naval Architects and Marine Engineers, Engineers Club of New York, and of the New York Yacht club.

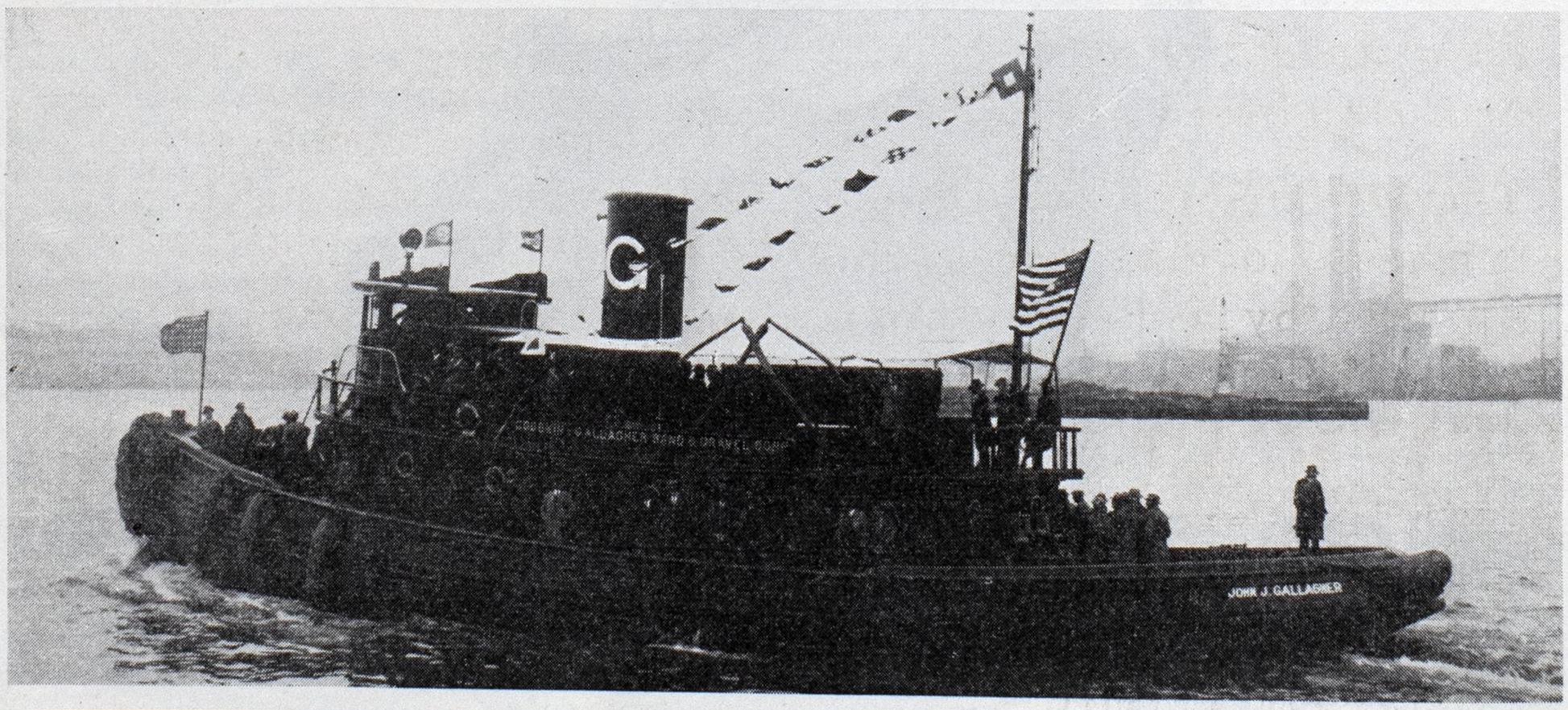
Trial of Diesel Tug John J. Gallagher

INCREASING use of the internal combustion engine in all types of harbor craft and in smaller vessels generally, is clearly indicated in new construction of these types. There are many hundreds of craft plying New York harbor and the waters of the East and North rivers. This great fleet is constantly being added to and as the years go on, must be replaced. The diesel engine has already become a factor in such new construction and in replacements.

One of the most recent new additions is the tug JOHN J. GALLAGHER, built and owned by the Goodwin-Gallagher Sand & Gravel Corp. The new vessel of especially sturdy wooden construction, measuring 100 feet in length overall; 92 feet 10 inches in length on water line; 25 feet in molded breadth; 26 feet 10½ inches in overall breadth; with a depth of hold of 10 feet 2 inches; and depth molded, 11 feet 8½ inches, powered with one direct connected 700 horsepower, at 250 revolutions per minute Fairbanks-Morse diesel engine, is said to be the largest diesel tug now operating in New York harbor.

A trial trip of the JOHN J. GALLAGHER was held on Nov. 11. The vessel left Port Washington, Long Island at 8:00 a.m., arrived at pier Forty-second street and East river at 10:10 a.m., at which point a large inspection party was picked up. The trial run commenced at 10:45 a.m. proceeding down the East river around the Battery and up the North river touching at pier foot of Fifty-first street. From thence the trial continued up the North river to the Harlem river through the Harlem and down the East river back to the pier at the foot of Forty-second street, arriving there at 4:10 p.m.

This trial trip went off smoothly and without special incident.



John J. Gallagher, Largest Diesel Tug in New York Harbor. Fitted with one 700 Horsepower Fairbanks-Morse Engine

Bureau Appoints Load Line Technical Adviser

Mr. Edwin C. Bennett, New York city, of the United States load line committee, has been appointed in the bureau of navigation in the capacity of technical advisor in connection with operations dealing with a comprehensive study of load-line legislation in the coastwise and intercoastal trade and on the Great Lakes, in pursuance of a resolution adopted by the senate on March 1, 1929.

The United States load line committee has been working on the problem of load-line regulation for two years. The committee was instrumental in formulating the present law applying to vessels in foreign trade and is now assisting the department in the study of the application of load-line requirements to coastwise and Great Lakes trade. It has been assisted, of course, to a great extent by the work and experience of Great Britain and by the rule which they have promulgated.

Many Lake Disasters

Unusually severe storms that swept over the upper Great Lakes in September and October caused the heaviest loss of life and property in many years. The damage on Lake Michigan has never been equaled in one brief season. Four vessel disasters on Lake Michigan took a toll of 100 lives. Much property damage was done ashore by the Great Lakes storms of Oct. 22-24.

On Oct. 22, the car ferry MILWAUKEE, of the Grand Trunk Milwaukee Car Ferry Co., was lost off Milwaukee with a crew of 52. The Goodrich Transit Co. steamer WISCONSIN also sank in Lake Michigan off Kenosha, Wis., on Oct. 29, with a loss of 16 including the crew. The freighter SENATOR, of the Nicholson-Universal Steamship Co., went down on Oct. 31 after a collision in a fog 20 miles off Port Washington, north of Milwaukee, with the ore boat MARQUETTE, of the Cleveland-Cliffs Iron Co. The SENATOR carried a cargo of 249 new automobiles being shipped by the Nash Motors Co., Kenosha, Wis. Capt. George Kinch, Ogdensburg, N. Y., and six others, were lost.

Twenty-five Ships Sold for Foreign Service

The sale of 25 cargo vessels for operation abroad, between Vladivostok, Siberia, and Petropavlovsk, Kamchatka, Siberia; Black Sea ports and Leningrad; Black Sea ports and Vladivostok; and Black Sea ports and Persian Gulf ports, with privilege of transfer to foreign registry was authorized by the shipping board on Nov. 13 to Johann G. Ohsol, an American citizen residing in New York. Sale was made for $1,155,000, payable 25 per cent cash with the balance covered by an irrevocable letter of credit payable in one year.

Expansion of Inspection Service Is Urged

A substantial expansion in the federal steamboat inspection service must take place to cope with the increased responsibilities placed upon it as a result of the growth of our merchant marine, in the opinion of Dickerson N. Hoover, supervising inspector general, whose annual report was made public on Nov. 23. The minimum number of additional inspectors needed in order to bring the service up to the desired point of efficiency Mr. Hoover places at 50, pointing out that with his present inadequate force it is physically impossible to make the required number of inspections and reinspections.

Under the present system, the report declares, it is impossible to maintain a uniform administration of the inspection laws, rules and regulations governing hull and boiler construction, and Mr. Hoover urges the creation of a central organization of technical experts at Washington who will be competent to pass upon the construction of the hulls and boilers from an accurately scientific point of view.

Big Diesel Works Sold

The American Locomotive Co. has acquired control of the McIntosh & Seymour Corp., Auburn, N. Y., manufacturer of diesel engines for marine, stationary and transportation use.

Confers Honor on Commodore Cunningham

ON BOARD of his ship, the S. S. LEVIATHAN, *Commodore Cunningam was recently decorated with the decree and insignia of the Crown of Roumania by T. Tileston Wells, Roumanian counsel general of New York. J. Harry Philbin, vice president of the United States Lines Operations Inc. represented the company at the presentation, while the officers of the vessel stood at attention as a tribute to the Commodore.*

Naval Architects Meet

(*Continued from Page 22*)

13. *Comparison of Operating Costs of Engine Departments of United States Shipping Board Diesel and Steam Cargo Vessels,* by Capt. Richard D. Gatewood, C. C. U. S. N., retired, member.

Ending his long government service, the author in this paper presents the results attained by the first 12 shipping board vessels which were converted from steam to diesel drive under his general supervision. It is fair to say that every operator is very much interested in the actual operating results obtained for these diesel vessels. With complete detachment, without arguing or belaboring the point, Captain Gatewood in his paper gives first hand, actual evidence of the comparatively low operating cost of these diesel ships when compared with steam. The results of the 12 diesel ships have been compared with a number of reciprocating steam engine vessels and turbine steam vessels. The overall comparison shows that for ten diesel vessels at a speed of 11.18 knots the average expense of the engine department per day is $187.59 and per mile $1.31; while for four reciprocating steam vessels the similar expense per day is $255.13 and per mile, $1.84, this at an average speed of 9.94 knots; for three turbine vessels the average expenses are $259.84 per day and per mile $1.93 at an average of 9.83 knots.

A lively discussion followed the presentation of this paper. J. H. King, author of another paper presented during the meetings, objected strenuously to the method of comparing, as he said, the latest modern diesel ships with nine and ten year old, practically obsolete, steamships. Also, that the comparison is made for the steamship in a long run, much of it through hot water of the Mediterranean, the Red sea and the Indian ocean. The reply to Mr. King's objections by Mr. Bogert and by the author were in effect that since we do not find profitable trade around the cold waters of the North Pole it is essential even for steamships that they go where commerce beckons them. If this is true, and the hot waters of the Red sea and Indian ocean make the steamships suffer by comparison on account of the difficulties of maintaining a vacuum, that of course is a reflection in this particular instance on the type of machinery that will operate better in cold water. But it certainly cannot be used as an argument that the steamship is discriminated against.

With reference to comparing the new diesel ships with obsolete steamships the author pointed out that there simply were not any other steamships to compare them with and, furthermore, that the diesel ships referred to had engines which of their size, were the first ever built in the United States. Consequently, like everything new, they were somewhat of the nature of full-sized experiments. In other words the diesel engine building art has advanced since the first 12 to a great extent, so that the engines for the latter eight are far superior.

14. *Notes on Work of Great Lakes Shipyards in the World War,* by Henry Penton, council member.

What can be done in a pressing emergency under wise and energetic management is indicated by the record made in shipbuilding on the Great Lakes during the war period. This record has now been recorded fortunately, before it is too late, by the chief actor who was manager of this district for the Emergency Fleet. Corp. Never did the man better fit the emergency. He had years of experience in the design and building of ships on the Great Lakes. He had driving force and energy and beyond all, he had courage to say no and to cut red tape when it was necessary to prevent obstruction of the stream of new ships pouring down the St. Lawrence to salt water.

The paper covers the organization and territory covered in the Great Lakes district. Navigation impediments are noted. The construction program outlined for the Great Lakes district is given.

Delivery performance of the shipyards of the Great Lakes is given in detail; so are numerous expedients adopted to avoid delay. Some of these expedients may have been, strictly speaking, illegal, but they accomplished the purpose intended to get ships out as quickly as possible. The author gives data on riveting and also on general operating conditions.

He also gives belated credit, as he puts it, simple justice demands the correction of an error in the corporation records. The report of the vice president, April, 1919, shows an item of $4,550,000 as contribution for plants to the American Ship Building Co., the principal builder of the district. To the direct contrary, Mr. Penton says in his paper, there should be shown a contribution by the company to the Emergency Fleet Corp. of around $16,000,000.

In conclusion the author states that the builders of the Great Lakes have more reasons than the horror of war for hoping for continued peace. They did all that they contracted to do and a great deal more and while some saved their shirts, none had a full suit.

This paper was read to the society by Doctor Sadler, dean of engineering of the University of Michigan. He paid a fine tribute to the high intelligence and the self-sacrificing efforts of the author to make possible such a record in shipbuilding. A letter was received by the secretary of the society from W. H. Gerhauser, president of the American Ship Building Co. in which he gave his personal testimony through actual contact during the period, to the untiring labor and the skillful and courageous handling of this great shipbuilding program by Henry Penton as district officer for the Emergency Fleet Corp.

Offiers of the society were re-elected at the annual meeting. The thirty-seventh annual banquet was held at the Hotel Pennsylvania on the evening of Nov. 15. The president of the society, Homer L. Ferguson, presided as toastmaster and the speakers included the Hon. Ernest Lee Jahncke, assistant secretary of the navy; Hon. Royal S. Copeland, United States Senator from New York; Dr. John L. Davis, philosopher; Rear Admiral Hutchinson I. Cone, U. S. N., retired, commissioner, United States shipping board; Hon. Harrington Putnam; Maj. Gen. Hanson E. Ely, U. S. A.; and Supervising Inspector General Dickerson Hoover.

Senator Copeland, has been in close contact with recent marine legislation and he stressed particularly the mandate of congress in the law of 1920 which was specifically reaffirmed in the merchant marine act of 1928, known as the Jones-White bill, that every officer of the government is instructed to use every effort to foster and build up a merchant marine, privately owned. Under this mandate there could be no legal question of the rights of officers of the government to use the aids provided by the law for the merchant marine. He mentioned specifically that a purchaser of shipping board lines under this act was entitled to the aid of mail contracts and that the United States lines purchased in good faith, after thorough investigation, were entitled to this aid, so that they can proceed with the program of new building.

General Hoover, in a speech that was very well received, stressed the importance of the work of naval architects and marine engineers in the development of safe ships as safety must lie first of all in the ship itself rather than in the auxiliary safeguards furnished as means for escaping from a ship in time of disaster.

On Turbine Propulsion

(*Continued from Page* 33)

(*e*) *Efficiency.*—Comparing turbine with turbine in the two types of drive, the performance is at a stand off, i.e., for the same steam and vacuum conditions the Rankine cycle efficiencies on a turbine brake horsepower basis neglecting the astern element are about the same when an honest effort is made to get the best in each case. However, when including the astern element, transmission efficiency and auxiliary power requirements such as excitation, ventilation, lubrication, etc., all as considered in the overall fuel rate per propeller shaft horsepower hour, the modern, efficient geared turbine is the more efficient. The percentage difference in fuel rates is less in the case of the larger drives.

(*f*) *Operating Cost.*—This item combines the investment charges on the first cost and the fuel cost and is in favor of the geared turbine. The exact amount varies and is influenced by many factors. The difference is appreciable in some cases and relatively inconsequential in others. A full and detailed comparison of this item would be very complicated and likely indefinite when made in any except a specific case. The investment cost differential is smaller in the case of the lower powers and greater in the case of the higher powers. On the other hand, the fuel cost difference is a greater percentage in the lower powers than it is in the higher powers.

(*g*) *Astern Power.*—Much has been said concerning the relative performance of the two drives in astern power. Geared turbine arrangements will supply anywhere from 25 to 70 per cent horsepower astern, depending upon the design and character of the astern elements. Electric drive using a single winding motor will supply 100 per cent astern horsepower at the motor shaft. Electric drive using two separate pole combinations in the motor windings will supply from say one-third to full horsepower astern, depending upon the control arrangements. There are ships of all mentioned astern characteristics for both types in service, and their astern power seems to be ample. It is true that ordinary ships are not built to run astern at full power, else the propeller would be symmetrical for ahead and astern operation or bow and stern propellers would be installed such as is the case with double ended ferryboats. Ample torque is the necessary characteristic for quickly stopping and reversing a ship, and this is available in the required amount in both types. Service demonstrates this. It is a fact that the modern, efficient geared turbine will turn to its full astern revolutions per minute in the same or less time than the modern, efficient electric drive. Since full horsepower can be developed in either direction by the electric drive, higher astern revolutions per minute can be obtained. With the proper control arrangement the modern efficient geared turbine will handle as easily as the electric drive.

(*h*) *Complication.*—To those who understand electrical apparatus there is nothing to the argument of "complication." To the electrical man, the mechanical drive looks complicated. It is true that the turbine power goes through a number of carriers, in the electric drive, before reaching the propeller shaft, but in the final analysis they are all simple enough, as well as reliable, if understood and cared for.

(*i*) *Weight and Space.*—The weight of a modern, efficient geared turbine drive (not including boilers, condensers, and auxiliaries) is about 50 to 60 per cent that of the electric drive. Also, the net floor space is usually less for the geared turbine. However, the items of weight and space are not always important. The machinery arrangement is in many cases favorable to the electric drive, both from the hull standpoint and also from the piping standpoint. A definite evaluation of these items can only be determined in connection with a specific case.

(*j*) Racing of propellers when leaving the water is purely a matter of turbine governor and can be avoided easily in either case by providing the turbine with a speed governor. Such a governor is essential with the electric drive, and is also supplied with certain makes of geared turbine drive.

(*k*) *Intangible Advantages.*—This item favors the electric drive on the following counts:

1. Torsional vibrations, when and as they may be set up in the propeller and line shafting, are not transmitted to the ship structure.

2. In the case of casualty to a prime mover the shift to the emergency set-up can be made in a few minutes, whereas in the geared drive considerably more time would be required. This is relatively important, particularly in comparison with a geared installation in which the emergency piping and valves are not installed.

3. Unidirectional turbines with consequent simplification and elimination of the astern element.

4. Shutting down of one prime mover unit for inspection or repair to its condenser. If divided water boxes are used, tubes may be plugged without shutting down the turbine, but no extensive repairs can be made while the turbine is operating.

5. The balancing of turbine rotors after installation, and like adjustments, are more conveniently made in the electric drive.

For the fuel rate analyses two arrangements are considered: first, a 5000 shaft horsepower single-screw vessel, and second, a 30,000 shaft horsepower twin-screw vessel. The fuel rates are computed for turbine-electric and geared turbine propulsive machinery, and in both cases the analyses show the differences to be expected using dual drive (turbine-electric) or attached generator (geared turbine), and using diesel driven auxiliary sets instead of turbine driven auxiliary sets.

The following steam conditions and

Fuel Rate Calculations for 30,000 S. H. P.—Twin Screw

	Geared turbine			Turbine electric	
	A	B	C	D	E
Condensate temperature, deg., F	88	88	88	88	88
Rise in air ejector cooler, deg., F	5.9	6.0	6.3	5.7	5.7
Rise in feed tank, deg., F	23.6	23.7	23.7	23.6	23.8
Rise in L. P. heater, deg., F	87.5	87.3	87.0	87.7	87.5
Rise in H. P. heater, deg., F	95	95	95	95	95
Final F. W. temperature, deg., F	300	300	300	300	300
Steam to air ejectors, lb./hr.	1,300	1,300	1,300	1,300	1,300
Steam to main condenser, lb./hr.	202,000	218,000	204,000	205,000	225,000
Steam to aux. generator, lb./hr.	19,400	.....	*	23,600	.....
Steam to main feed pump, lb./hr.	5,500	5,500	5,500	5,500	5,500
Steam to misc. heating, etc., lb./hr.	5,000	5,000	5,000	5,000	5,000
Steam bled to L. P. heater, lb./hr.	16,400	16,000	14,500	17,200	16,750
Steam bled to H. P. heater, lb./hr.	27,700	27,200	25,500	28,500	28,100
Steam from boilers, lb./hr.	277,300	273,000	255,800	286,100	281,650
Power developed by main units, S.H.P.	29,650	29,610	29,680	29,550	29,400
Power developed by aux. gen., Kw	1,500	1,500	1,500	1,830	1,830
Boiler efficiency, per cent	85	85	85	85	85
Heat value of fuel, B.t.u./lb	19,000	19,000	19,000	19,000	19,000
Heat rate—steam only, B.t.u./S.H.P./hr.	10,150	10,000	9,350	10,510	10,390
Fuel rate—all purposes, lb./S.H.P./hr.	0.629	0.619	0.610	0.652	0.644
Fuel rate—corrected for price of diesel oil using 1.5 differential, lb./S.H.P./hr.	.....	.....	0.625	.....	.....

*920 lbs. fuel oil per hour to diesel engines.

A and D=Auxiliary current supply from condensing turbine driven generators.
B=Auxiliary current supply from generators driven by the main unit.
C=Auxiliary current supply from diesel driven generators.
E=Auxiliary current supply through transformers from main units.

NOTE.—The author expresses his thanks to Mr. Harold Anderson for the preparation of "Fuel rate calculation tables."

feed temperature used in the analyses are regarded as very conservative, and it is recognized that higher pressures and temperatures are entirely feasible in both types of drive:

400 pounds gage boiler pressure.

375 pounds gage throttle pressure.

250 degrees F. superheat at the turbine throttle.

693 degrees F. total temperature at the throttle.

28½ inches vacuum at the turbine exhaust.

300 degrees F. feed water temperature employing two-stage feed heating.

85 per cent boiler efficiency.

19,000 B.t.u. oil.

It is assumed that the drop in pressure between the boiler and turbine of 25 pounds will just balance the radiation losses and develop sufficient heat to maintain a constant superheat.

Admittedly, there are numerous minor variations possible which would modify the ultimate result slightly one way or the other. For instance, all or a portion of the auxiliary sets could be operated noncondensing and their steam used for feed heating or led into a low pressure stage of the main turbine, or both, with a slight gain in efficiency. However, such arrangements lead to a certain degree of complication, and whether or not they are justified depends upon the particular installation. Since the two types of turbine drives are considered, care has been taken to place all calculations on the same or equivalent basis. When considered on this basis, calculated comparative performances are a better barometer than figures taken from vessels in operation because of the unknown factors in the latter and the extent to which the human element influences the results. Fuel rates to be of any comparative value must be specific concerning what items they include and the manner of arriving at the result.

In any analyses of economy it is entirely correct to consider the propulsive plant together with its direct auxiliaries and accessories as representing one phase, and the ship's plant such as lighting, heating, cooking, ventilation, etc., as another phase. The ship's plant will have no appreciable influence on the analysis of the propulsive plant except the cost rate at which auxiliary power is supplied, and this can be duly allowed. Therefore, since the ship's plant load varies so widely for different types of ships and different trade routes, an average condition has been estimated and introduced into the analyses in order to get a better idea of the actual total.

The fuel rate tables are self-explanatory; however, it is of interest to note the relatively small saving effected by the use of the dual drive and attached generator. This is to be expected in the case of the 30,000 shaft horsepower ship. It is also of interest to note that, considering first cost and fuel cost, diesel driven auxiliary sets are not justified in the cases cited.

In my judgment the opportunity afforded by the society for discussing and airing these important subjects is a splendid and healthy condition. It has been through the medium of frank discussion of the merits of the different forms of machinery that have been designed to perform certain functions that land machinery has progressed to its present high degree of efficiency and dependability. Perhaps there has not been sufficient discussion of this nature in marine

(*Continued on Page* 64)

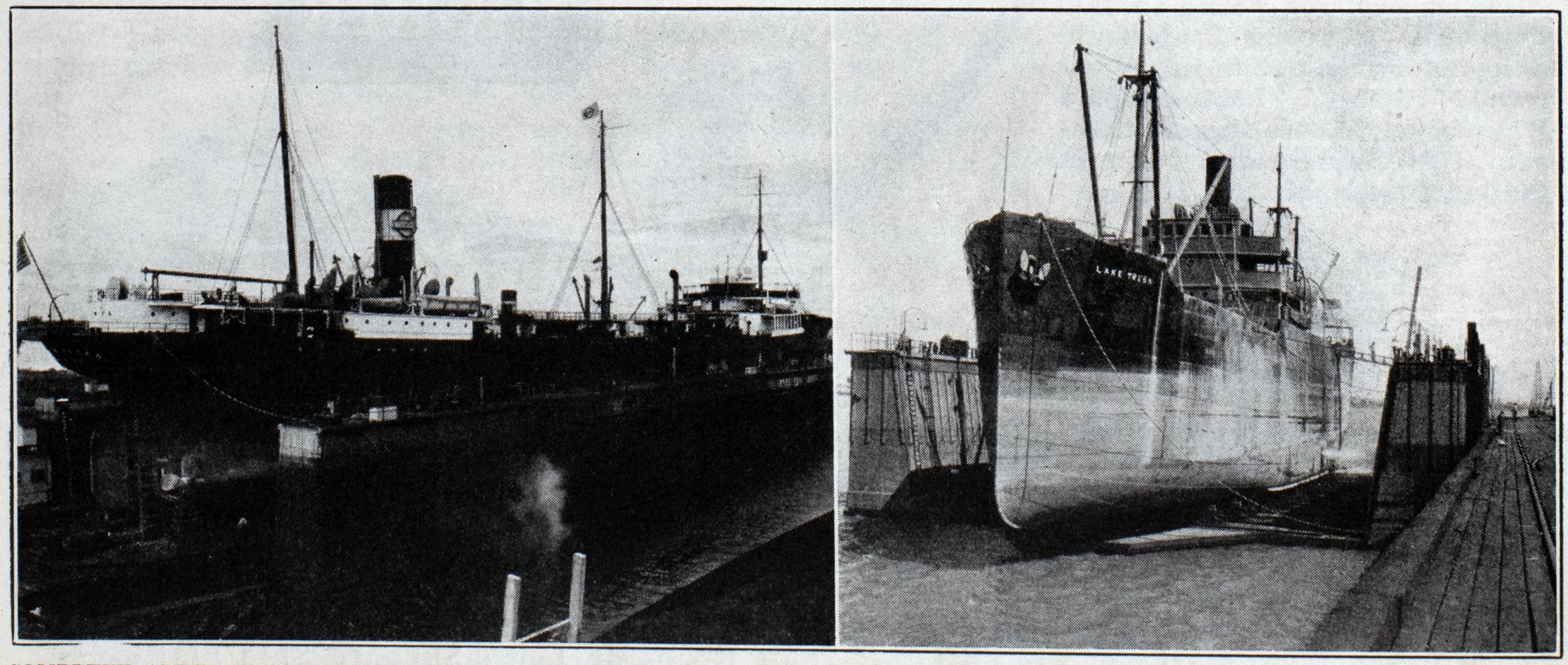
Repair Facilities in Gulf Increased

RECENT completion of the extension and enlargement of the plant of the Todd Shipbuilding & Dry Dock Co. Inc. at Mobile, Ala., makes this subsidiary of the Todd Shipyards Corp. the largest and most modern ship repair plant in the gulf.

Additional property acquired permitted the extension of the plant frontage on the Mobile river channel by about 600 feet. The principal work in the new improvement was the dredging of about 600,000 cubic yards, so that the area devoted to piers and ships would have a minimum depth of water of 30 feet.

Old shipbuilding ways were removed, a steel sheet pile bulkhead and two piers were constructed. The piers are 600 and 700 feet long and provide two slips or basins, one 210 feet wide by about 800 feet long and the other 220 feet wide by about 800 feet long. Each pier has a standard gage railroad track running its full length and connection with shore tracks, used for railroad cars and locomotive cranes handling machinery supplies and steel plates and shapes.

Besides complete shop equipment, consisting of machine shop, plate shop, a new coppersmith shop, electric, woodworking and other ship repair facilities, this plant has two floating drydocks of 12,000 tons and 8500 tons lifting capacity, respectively.



COMPLETE ADDITIONAL FACILITIES OF TODD SHIPYARDS CORP. AT GULF YARDS. LEFT—TANKER A. C. BEDFORD IN NEW DRY DOCK AT THE MOBILE, ALA. PLANT. RIGHT—STEAMSHIP LAKE TREBA IN DRYDOCK AT ALGIERS (NEW ORLEANS) PLANT

Turbine Propulsion

(*Continued from Page* 62)

circles during the past several years. I am fortunate in being able to state that the engineers of the company with which I am connected are neither pro-turbine electric, nor pro-geared turbine, nor pro-diesel, nor pro-diesel electric. We are carrying on developments and research work having for their object improvements in every phase of propulsive equipment; and we are regarding the importance of developing our merchant marine in the same degree that we regarded the development of land industries.

It is well that the open-mindedness of the American engineer, naval architect, shipbuilder and shipowner has resulted in the building of ships with turbine-electric, geared turbine, diesel and diesel-electric drive. All undoubtedly have their merits and their place; however, it is only by frank and open discussions, and by the conducting of properly directed research and development of all promising types of propulsive equipments, that the best in each can be brought out. This paper has been purposely written with the thought of bringing out discussion, because from discussion and exchange of views all progress is largely made.

Electrical Awards Made

CONTRACTS were recently awarded covering the installation of electrical machinery and auxiliaries in the two new superpassenger liners building for the Dollar line by the Newport News Shipbuilding & Dry Dock Co. The Westinghouse Electric & Mfg. Co. was awarded the contract for one ship while the General Electric Co. was given the other. These ships, which will be the largest and highest powered commercial vessels ever built in American shipyards, will be propelled by turbine electric machinery developing 26,500 shaft horsepower with a designed speed of 20 knots.

Power for the propelling motors is furnished by two main turbine generator sets which operate with steam at 275 pounds gage throttle pressure and 200 degrees Fahr. of superheat. The turbines exhaust into a vacuum of 28 inches, the condensers being installed below the turbines. Each set is rated 10,200 kilowatts, at 4000 volts, 3 phase, at a speed of 2660 revolutions per minute at full power. The main generators have a closed system of ventilation, water-cooled air coolers being used. The turbines are of the well known Westinghouse combination impulse and reaction type.

The two propelling motors, driving twin screws, are of the synchronous induction type, each rated at 11000/13250 shaft horsepower at a speed of 125/133 revolutions per minute. The motors have an open system of ventilation which exhausts on deck. Cooling air is provided by two blowers, each driven by a 25-horsepower motor and capable of delivering 37,000 cubic feet per minute against static pressure, 2½ inches of water.

The propulsion control employs air brake main switches, operated by levers and completely interlocked. Under normal conditions each turbine generator set supplies power directly to a propelling motor, but provision has been made for driving both motors from one turbine generator set which permits economical steaming at reduced speeds. With the latter arrangement, about 65 per cent of the ship's full speed can be kept.

Auxiliary power is furnished by four Westinghouse turbine generator sets of 500 kilowatts each, operating at the main line steam conditions of 275 pounds with 200 degrees of superheat.

The electrified deck auxiliaries include 20 cargo winches driven by 35-horsepower motors and four 25-horsepower winches; an anchor windlass driven by a 75-horsepower motor; two warping capstans each driven by a 75-horsepower motor; two automobile capstans, each equipped with a 15-horsepower motor and two boat hoists, driven by 25-horsepower machines. All of the deck auxiliary motors are of the Westinghouse waterproof type.

The electrified underdeck auxiliary machinery comprises the following equipment; four 100-horsepower main circulating pumps, two 30-horsepower auxiliary circulating pumps, two 75-horsepower motors for the steering gear, two 50-horsepower sanitary and deck wash pumps, three 10-horsepower main condensate pumps, three 5-horsepower auxiliary condensate pumps, one 15-horsepower ballast pump, two 7.5-horsepower fresh water pumps, one 5-horsepower hot fresh water pump, one 3-horsepower ice water circulating pump, four 100-horsepower CO_2 compressor motors, two 20-horsepower brine circulating pumps, two 7.5-horsepower CO_2condenser circulating pumps, four 22-horsepower forced draft fans, two 10-horsepower engine turning motors and one 5-horsepower shop motor.

Carferry Is Completed

(*Continued from Page* 30)

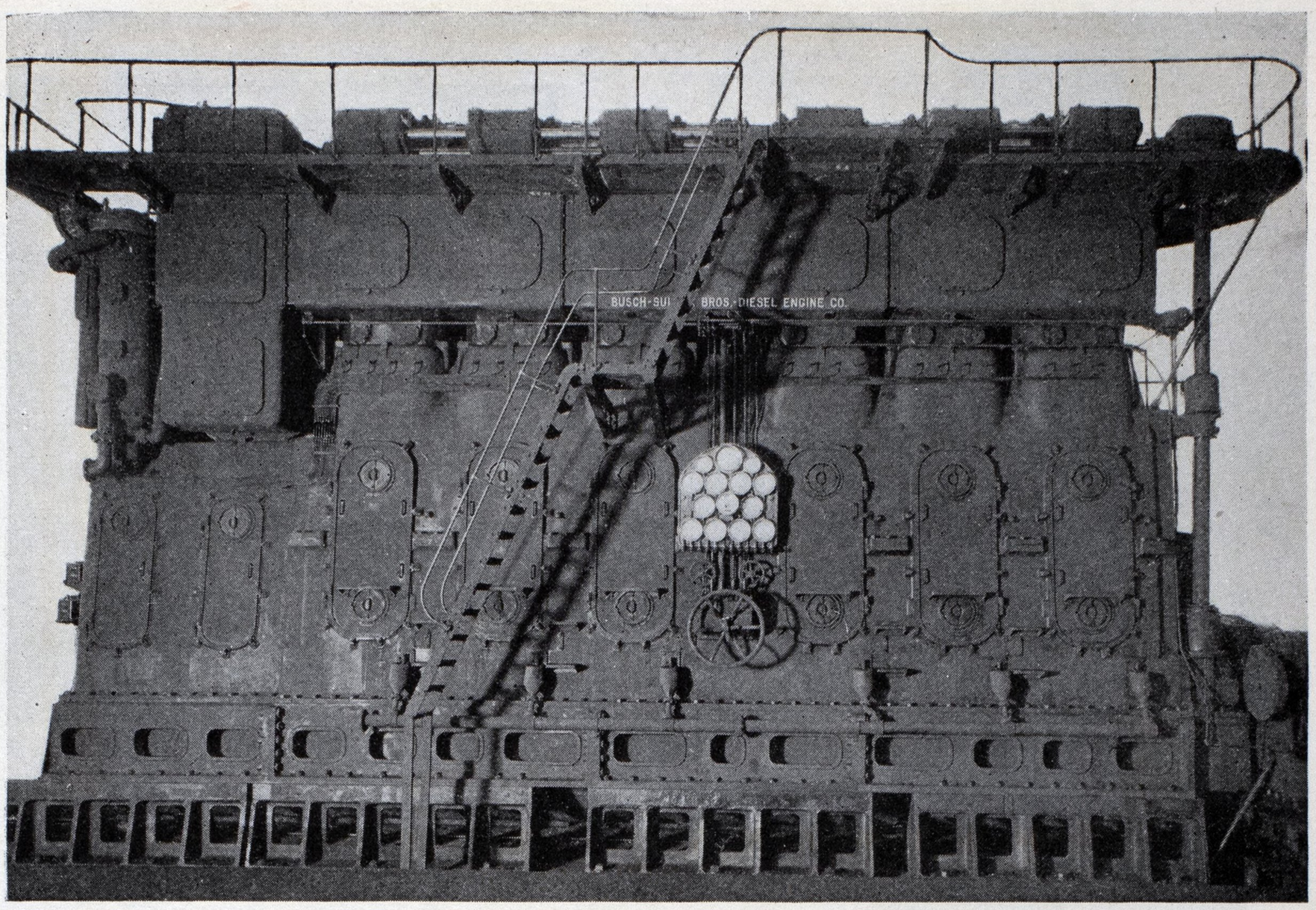
solid chunks of ice. In this machinery, furnished by the General Electric Co. special care was taken in the design of relays and contactors to automatically limit the torque put on the propellers. In other words maximum power is provided for propulsion without going over a definitely determined load on the propeller shaft and the propulsion machinery.

A powerful windlass of spur geared type is driven by a 50 horsepower alternating current motor. This windlass was built by the Manitowoc shipyard. It is capable of handling two anchors of 4700 pounds each. Forged anchor chains of 1 15/16 inches diameter are used. A constant tension mooring winch located on the forward deck is of Benson Electric Co. design and manufacture. It is driven by a 50 horsepower direct current General Electric motor. This type of winch has been found to work out successfully on the Ford ships and also on the later Bradley Transportation Co. ships. There are also four powerful motor driven worm geared gypsies furnished by the same company. The heads were built by the shipyard. Each of these gypsies is driven by a 50-horsepower alternating current Westinghouse motor. The gate hoisting engine was built by the shipyard and is driven by a 40-horsepower alternating current General Electric motor. As an emergency lighting set there is located on the spar deck forward a 5-kilowatt Kohler automatic gasoline engine driven generator. In case of need this set may be used for lights and for radio.

The CITY OF SAGINAW 31, on going into commission, is in charge of Capt. C. E. Robertson and chief engineer J. B. Conrad. Her operation in service will be watched with great interest.

For more than half a century the United States public health service has conducted examinations and periodical re-examinations to determine the visual and color perception of masters, mates and pilots of American vessels, at the request of the United States steamboat inspection service.

After a thorough study by a board of five medical officers appointed for the purpose, the surgeon general of the public health service has decided to introduce a more rigid or at least a more "foolproof" method of testing color vision, namely the colored plates test of the kind of which the Stilling's method is representative.



—WORLD CONSTRUCTION—

	Motorships	Steamers
6,000 to 8,000 tons	36	22
8,000 to 10,000 tons	33	11
10,000 to 15,000 tons	20	5
15,000 to 20,000 tons	10	0
20,000 to 25,000 tons	4	1
25,000 to 30,000 tons	1	2
30,000 and above	0	2
	104	43
All ships	1,531,753 G. T.	1,275,019 G. T.

BUSCH-SULZER

PIONEER DIESEL BUILDERS

-1898-1929-

Busch-Sulzer Bros.-Diesel Engine Co.

St. Louis, Mo.

S. S. *Olympic*, giant Atlantic liner of the White Star fleet, maintains an average of 22½ knots at 160 r.p.m.

J. H. Thearle, Chief Engineer, who retires next month.

2,000,000 miles with correct lubrication

The S. S. *Olympic* of the White Star fleet is the largest triple screw steamer in the world. J. H. Thearle her Chief Engineer, has been in the service of the White Star Line for 30 years, and a member of the *Olympic's* crew since she was launched.

Mr. Thearle retires next month with an enviable service record. The powerful engines under his care are in splendid condition after almost 2,000,000 miles of strenuous operation.

Like hundreds of other capable engineers throughout the world, Chief Engineer Thearle has proved through years of continued use that Gargoyle Marine Oils:

—are the best insurance against sudden breakdowns and costly repairs;

—cut down fuel and oil consumption,

—and lengthen the life of propelling machinery.

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NOTE: We will be glad to send you, without obligation, any of our three authoritative treatises on Marine Lubrication: "Steamships with Reciprocating Engines," "Turbine Propelled Steamships," "Marine Lubrication—Motorships." Please address your request to: Vacuum Oil Company, Marine Sales Department D-12, 61 Broadway, New York City.

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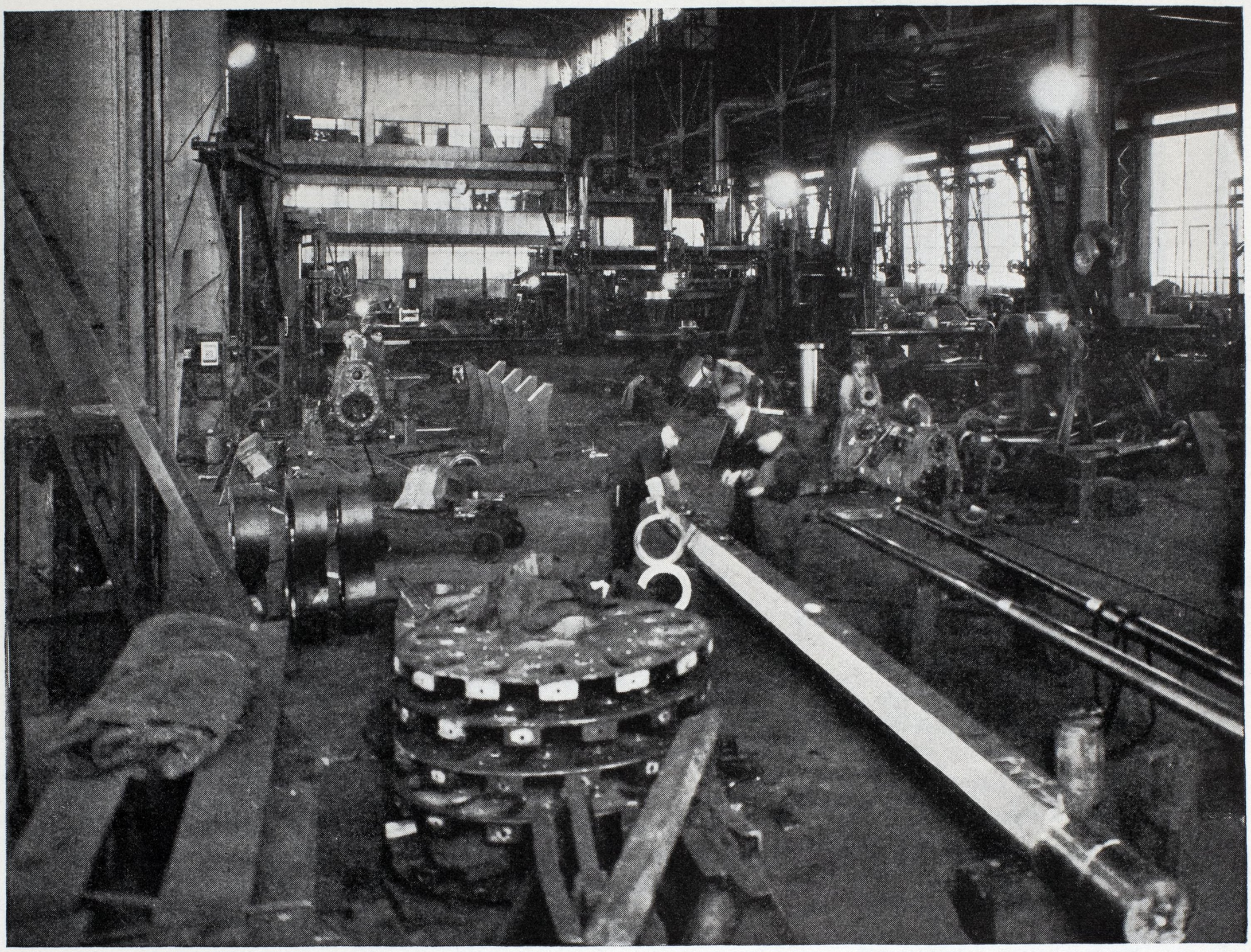
THIS IS ONE OF "AMERICAN'S"
where speedy, skilful work



THIS machine shop of "American's" is BIG—and it has to be, to handle the big parts that go to make up ships . . . that big shaft in the foreground . . . the cylinder . . . the great bed-plate . . . just ordinary size jobs. Yet this shop also handles small jobs efficiently, accurately and speedily.

No repair job is too big for "American"—none too small.

And this machine shop is only one unit of the complete repair resources that "American" maintains at each of its shipyards to serve

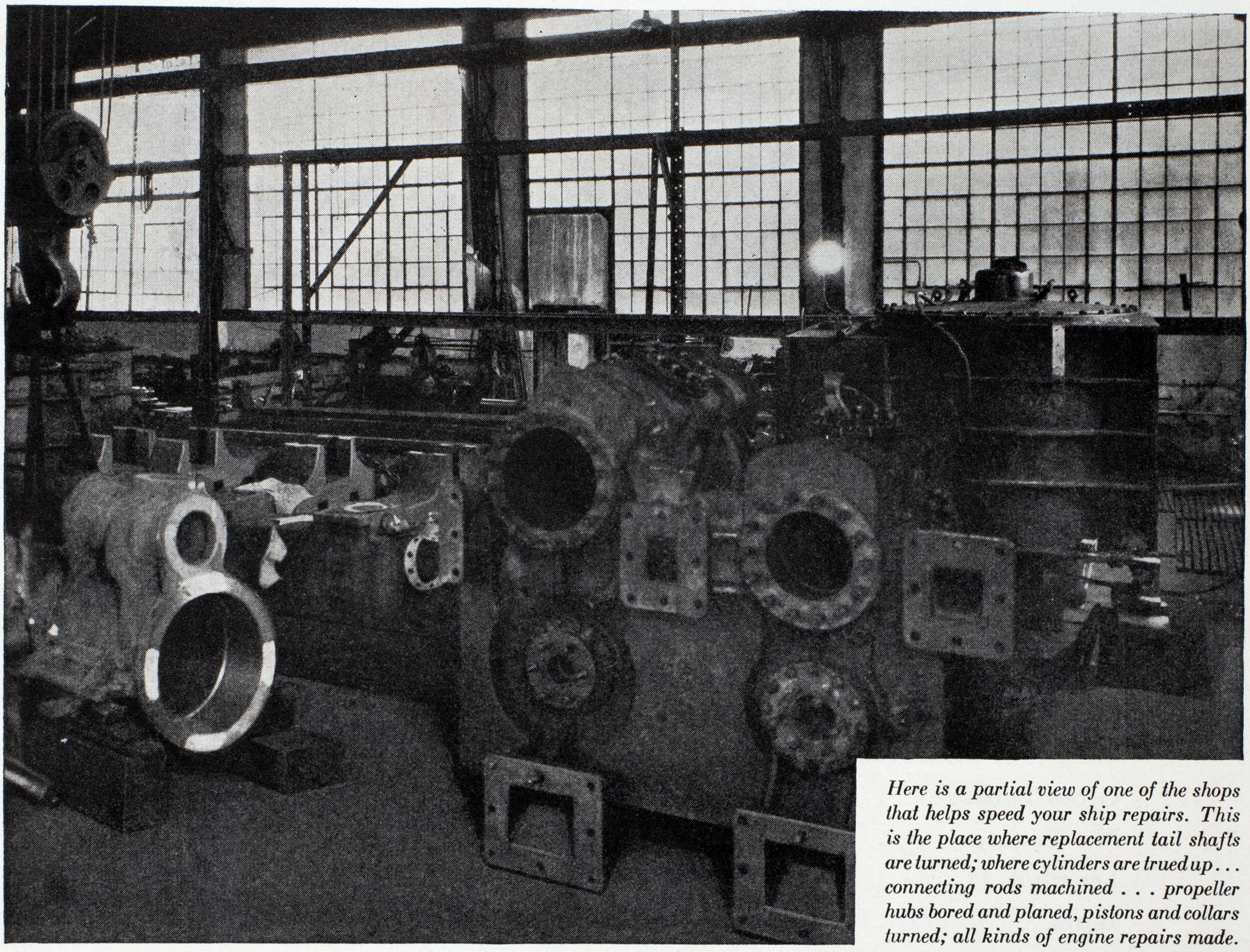
The AMERICAN

CLEVELAND
American Ship Building Co.

LORAIN
American Ship Building Co.

BUFFALO
Buffalo Dry Dock Company

FIVE MACHINE SHOPS
hastens your ship repairs



Here is a partial view of one of the shops that helps speed your ship repairs. This is the place where replacement tail shafts are turned; where cylinders are trued up . . . connecting rods machined . . . propeller hubs bored and planed, pistons and collars turned; all kinds of engine repairs made.

your ships swiftly, competently and economically on any size or kind of repair work.

Ship operators today realize that such facilities make the service of the large ship-building companies extremely versatile, flexible and complete.

They appreciate, as well, that it is important for them to *keep* this service that way by an unceasing flow of repair jobs, big and little.

That's why, more and more, ship operators are turning to "American Ship" for all their repair work.

SHIP BUILDING Co

SOUTH CHICAGO
Chicago Ship Building Co.

SUPERIOR
Superior Ship-building Co.

Launching of the S. S. "Santa Clara"

T. S. S. Passenger and Cargo Vessel now building for the

Grace Steamship Company

at the yard of the

NEW YORK SHIPBUILDING COMPANY

CHARACTERISTICS OF THE T. S. S. SANTA CLARA ARE:

Gross Tonnage	10,500	Draft	25 ft. 0 in.
Net Tonnage	6,300	S. H. P.	12,000
Length A. O.	505 ft. 0 in.	Speed	18 knots
Beam	63 ft. 9 in.	Turbo-electric Drive	
Depth	37 ft. 5 in.	First Class Passenger Accommodations	208 persons

Other Ships of the Grace Line built by New York Shipbuilding Company:

S. S. "SANTA ELISA" S. S. "SANTA TECLA"

S. S. "NORA"

This Delaware River yard offers the private ship owners of America the skill and facilities which make possible prompt delivery of vessels designed especially to meet the particular needs of their service.

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FEDERAL CONVERSIONS

Ships live a long time—today when past their first youth, they can be given a new lease on life by repowering and remodeling. The tendency for higher powers and higher speeds with more economical fuel consumption, and with limited passenger accommodations has been made possible and practicable. It is easy enough to build with entirely new materials and specifications—to "make over" economically and skilfully presents unusual problems, requiring the talent of a shipbuilding organization combined with a plant of extensive and diversified facilities to accomplish a satisfactory result. These requirements are fully met at FEDERAL . . . . The M. S. "Courageous" by conversion and reconditioning was changed from an obsolete freighter of 9½ knots to a modern 13 knot Diesel electric craft. The "E. T. Bedford", originally built at Federal with steam machinery, was converted at a later date to a direct-drive Diesel Tanker . . . . Others just as conspicuous are under way at present time. Federal's location near New York—30 minutes from business section—makes it convenient for owners to inspect their work—30 foot channel permits handling of large ships. These facts make it possible for FEDERAL to offer ships converted and reconditioned with the one ideal in mind—superiority of design—and workmanship.

that modern magic for ships—

conversions

FEDERAL is experienced in handling large reconditioning and conversion jobs—Some of the largest on the Atlantic Coast have been successfully completed—Unsurpassed shop facilities together with trained personnel make possible the greatest efficiency and economy both in time and expense of accomplishing the work. The Shipowner also has the advantage of dealing with an organization of ship-builders, familiar with all phases of marine work.

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has no regard for conditions. It is the toughest, sturdiest Manila Line on the market. Into it is spun more service per dollar than is obtainable in any towing line.

Actual use, as well as tests on our latest wear-producing machines, have proven that Columbian Manila Tow-Ro excels in strength, durability, waterproofing and flexibility.

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Guarantee—Tow-Ro has the broadest guarantee of the industry. It is identified by the *Tape-Marker* and the red, white, blue, white and red surface markers.

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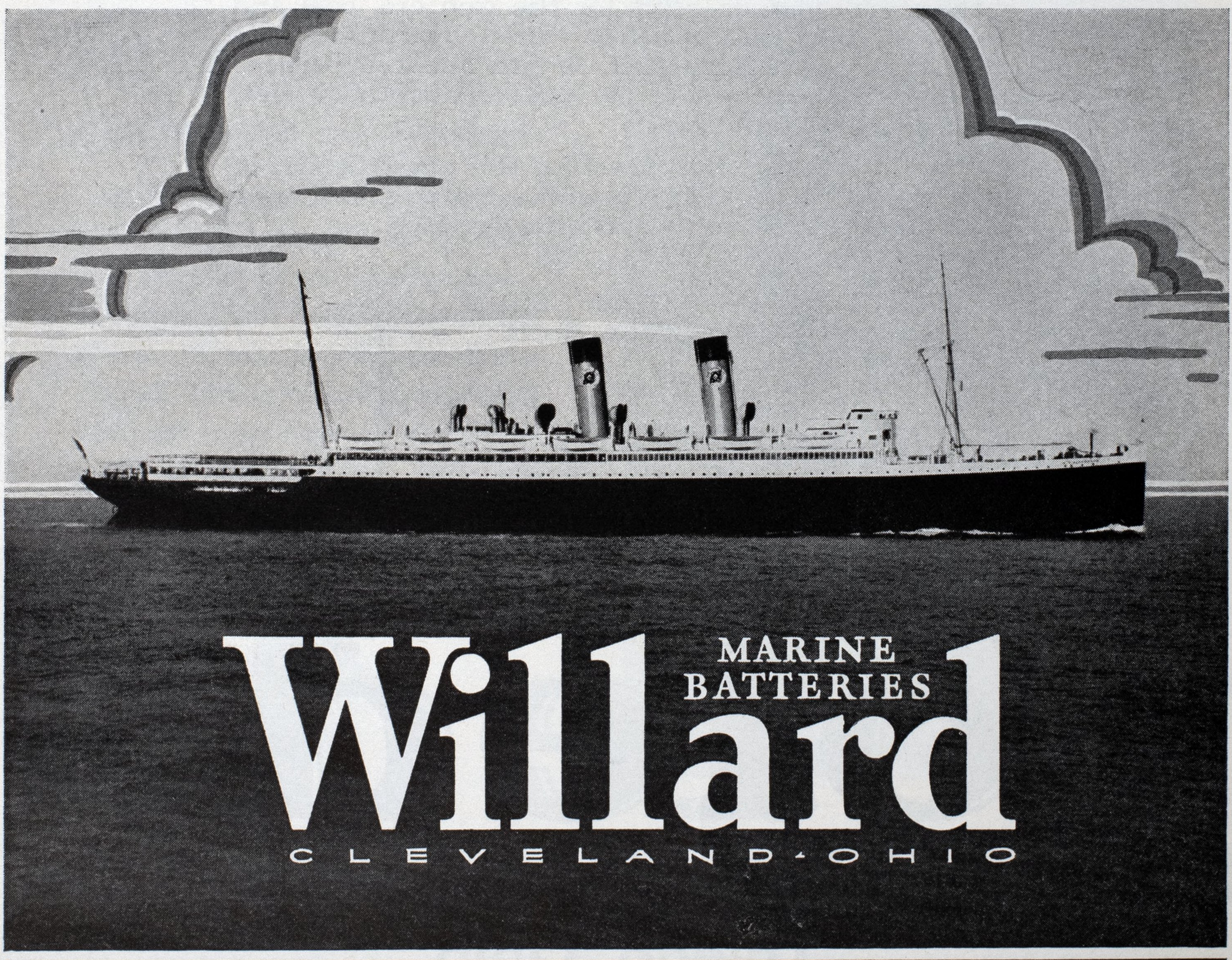

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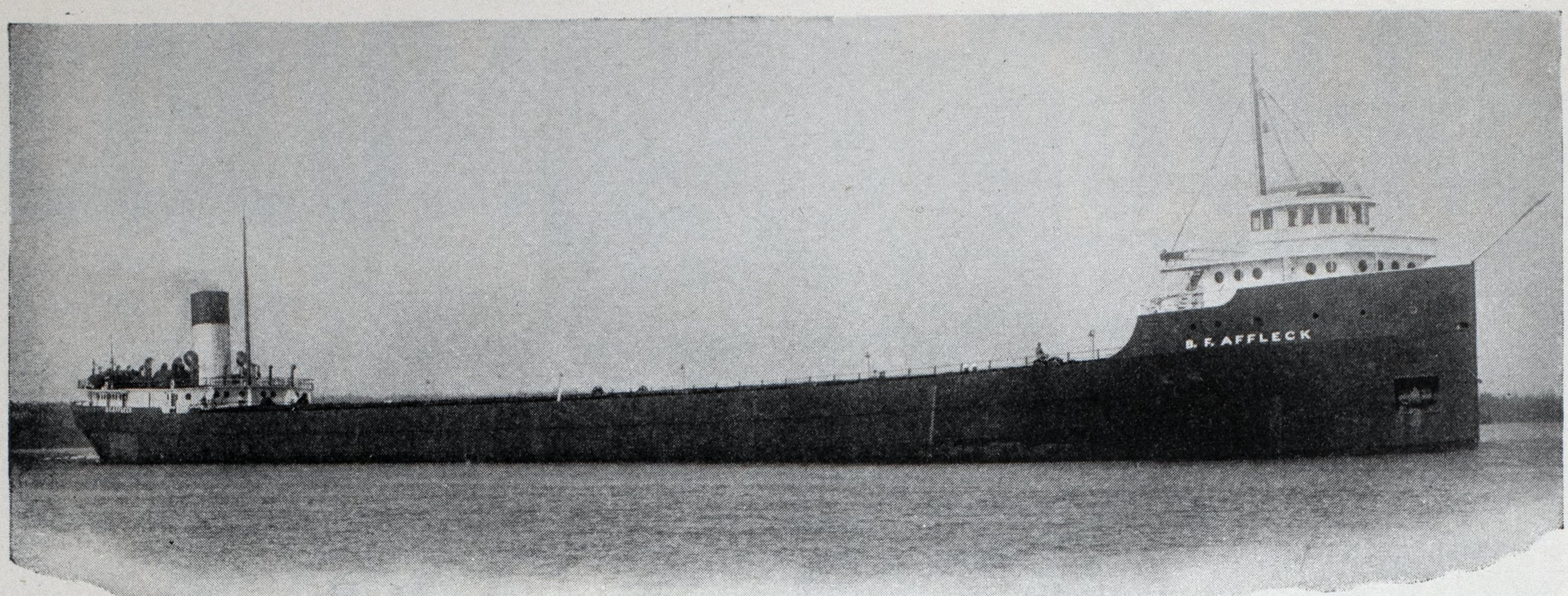

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Finest Type of Great Lakes Cargo Carrier

S.S. B. F. Affleck owned and operated by the Pittsburgh Steamship Company, is a single deck bulk cargo vessel of the standard type built for the iron ore, coal and stone trade of the Great Lakes. Her molded dimensions are: Length overall, 604 feet, length between perpendiculars, 580 feet; width 60 feet and depth 32 feet. Capacity 12,000 tons.

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Toledo
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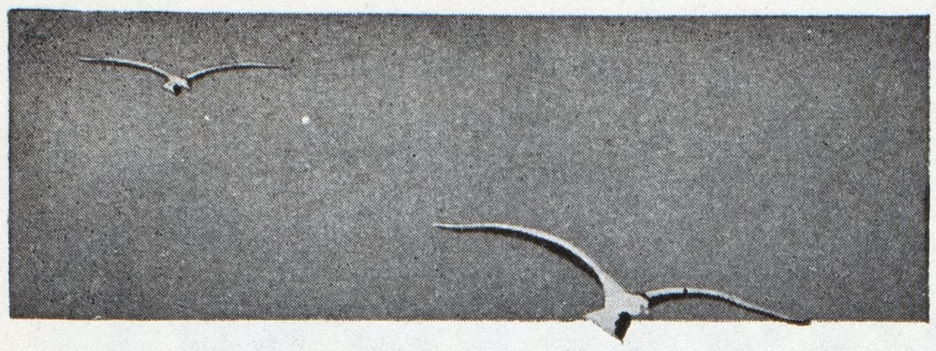

Completed— an ELECTRIC FLEET

THE first electric fleet has been completed. The I. M. M. *Pennsylvania*, launched within the year, has joined her Panama-Pacific sisters, the *California* and the *Virginia.*

These three are forerunners of the all-electric merchant marine; other electrically propelled vessels are building; still others are planned. They usher in a new era in ocean travel—an era of American ideals in ship-propulsion efficiency, an era of unbelievable comfort at sea.

General Electric manufactures complete turbine propulsion machinery, electric equipment for ships' auxiliaries, and marine accessories of many kinds. In this transitional period, its exceptional facilities and practical experience are at the disposal of ship builders and ship owners who would keep in step with maritime progress.

173-6

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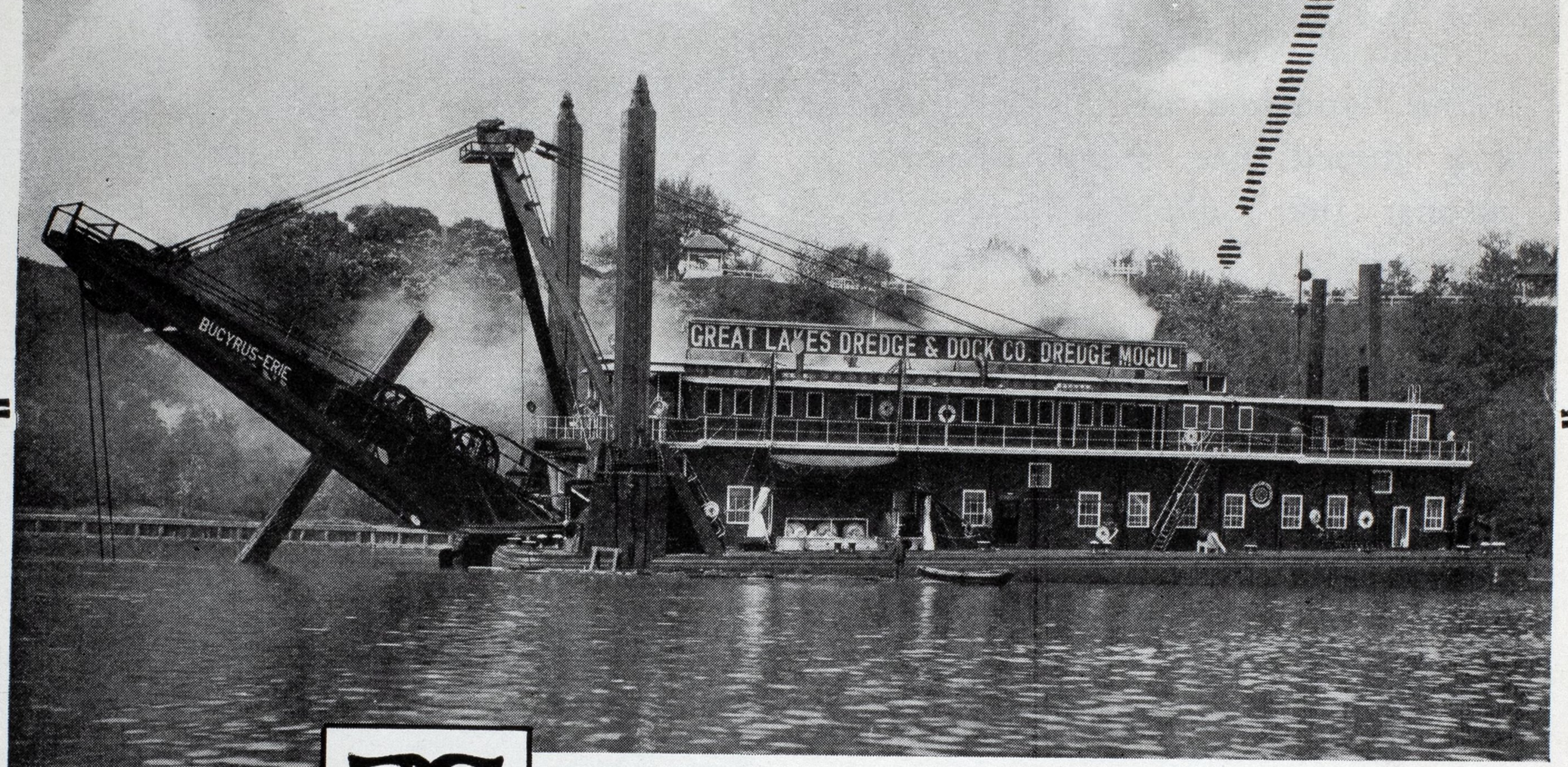
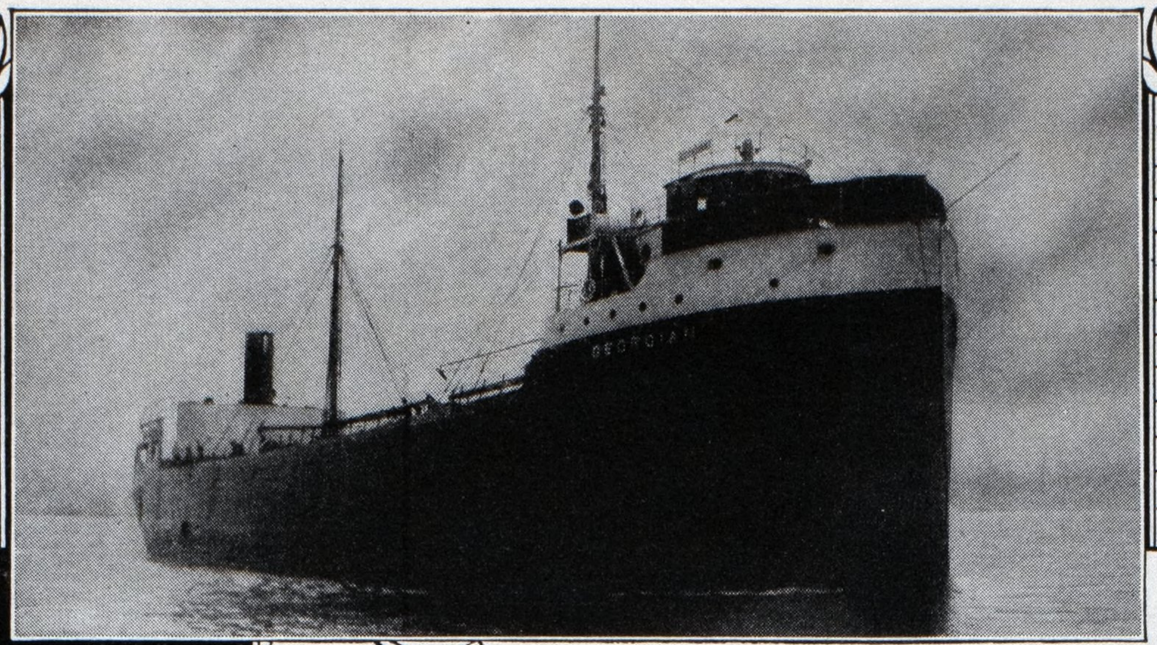


THE 8 cu. yd. Diesel Electric Dipper Dredge MOGUL was built for Great Lakes Dredge & Dock Co., Chicago. It is equipped with a 12 cu. yd. dipper for ordinary work but will heap up to a load of 16 yards in lighter materials. An 8 cu. yd. dipper is used for dredging rock. Maximum digging depth is 42 ft. of water. The MOGUL is 156'0" x 42'6" x 12'8"—1200 H.P., equipped with Bucyrus-Erie dredging machinery and Busch Sulzer Diesel engine. It has living quarters for a crew of twenty-three men.

It will pay you to consult Manitowoc when in the market for dredges, steel passenger and freight vessels, carferries, tankers, fire boats, sand suckers, tugs, scows, lighters, marine engines, marine boilers, ship auxiliary equipment, etc.

MANITOWOC SHIPBUILDING CORPORATION

Manitowoc, Wisconsin



The Black Sheep Turns White

THE career of the "Georgian" has indeed been a checkered one. Launched at Glasgow, Scotland, in 1912 under the name "Fordonian" this vessel first plied in ocean service, performing fairly well, but without the necessary flexibility. For this reason she was re-powered in an effort to make her perform profitably, but she still remained unsatisfactory.

In 1926 the "Fordonian" was taken over by the Paterson Steamship Lines, renamed the "Yukondoc" and placed in service on the Great Lakes in the bulk grain carrying trade. Here she quickly won the nickname "Black Sheep" as her performance was consistently unsatisfactory and unprofitable. She never could run a full season's schedule and lost money on each year's operation.

Again she changed hands, this time going into the possession of Captain Hudson who called her the "Georgian". Once again she was re-powered in a last desperate effort to make her pay—this time with Bessemer Diesel engines—and now the "Black Sheep" has turned white!

Her first season with Bessemer power showed a marked improvement over her past performance; her second season was a marked success. For the first time in her history the "Georgian" has run a full season's schedule! For the first time she has shown a profit!

What Bessemer Diesels have done for the "Georgian" is best expressed by her owner, Captain Hudson—

"I can frankly say that up to date I am very well satisfied with her performance. She handles easily in the canals, and has on the straightaway made as good, if not better speed, than any other steam vessel of the same class, canal and upper lakes included.

"I have not missed a schedule since commencement of operation this season, and manage a round trip, Toronto to Port Arthur, every two weeks."

What Bessemers have done for the "Georgian" they can also do for you, whatever the type of commercial marine service.

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Factory: Grove City, Pa.

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Diesel Power Limited, Adelaide Buildings, 129 Adelaide St., West., Toronto, Ontario, Canada

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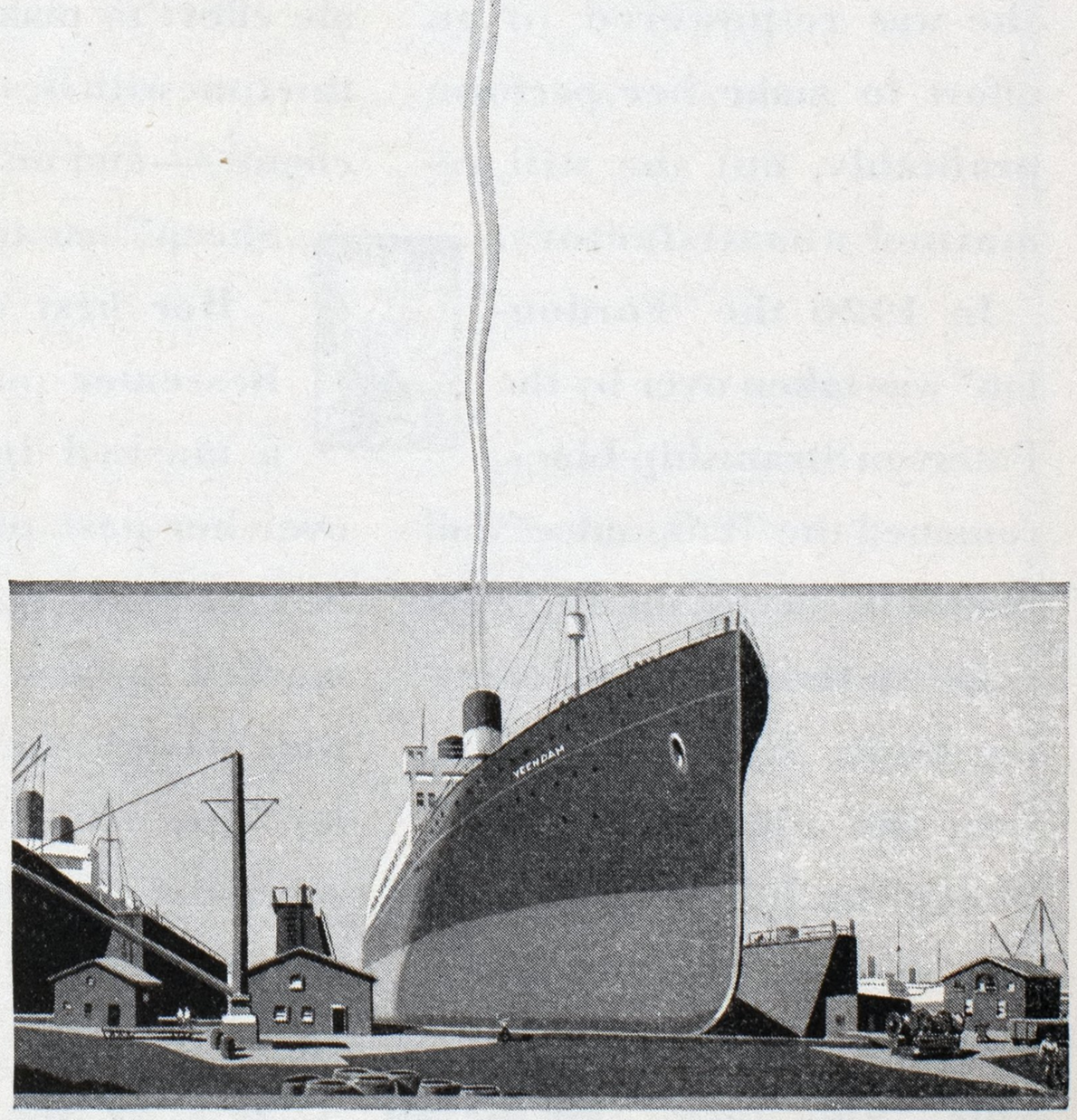

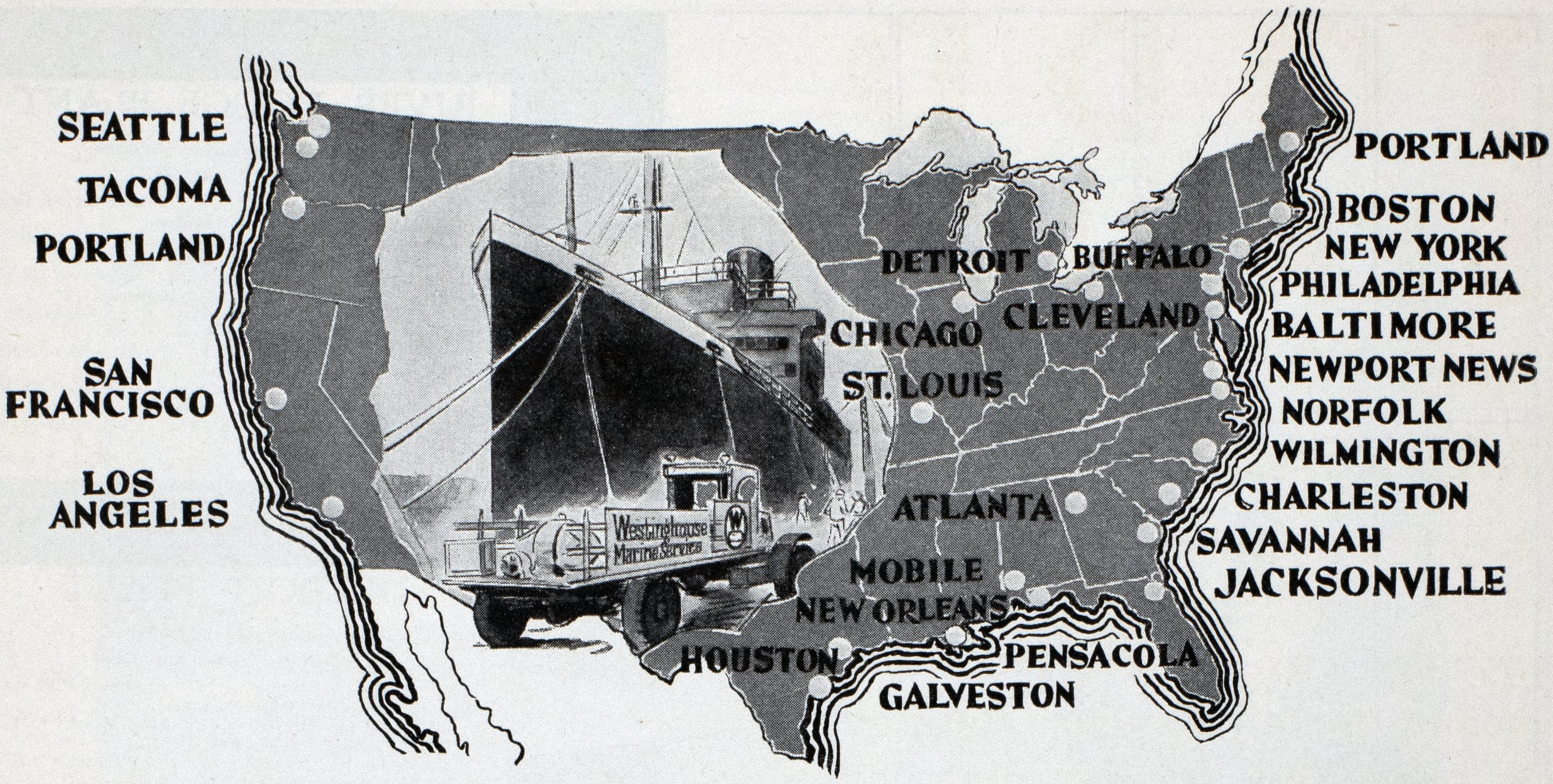

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THE service offered by a manufacturer of marine apparatus should always be a prime consideration in the buying of equipment.

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With its nation-wide organization, Westinghouse is admirably fitted to give the kind of service that the shipowner requires. Expert service engineers for steam and electrical machinery are available at a moment's notice, at any time of the day or night, in every important lake, river, and seaport in the United States.

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No yard in America offers a more complete service. The vast resources, unlimited facilities, large capacity, scientific scheduling system, highly efficient designing and producing organization perfectly coordinated and the splendid co-operation with the client insure—

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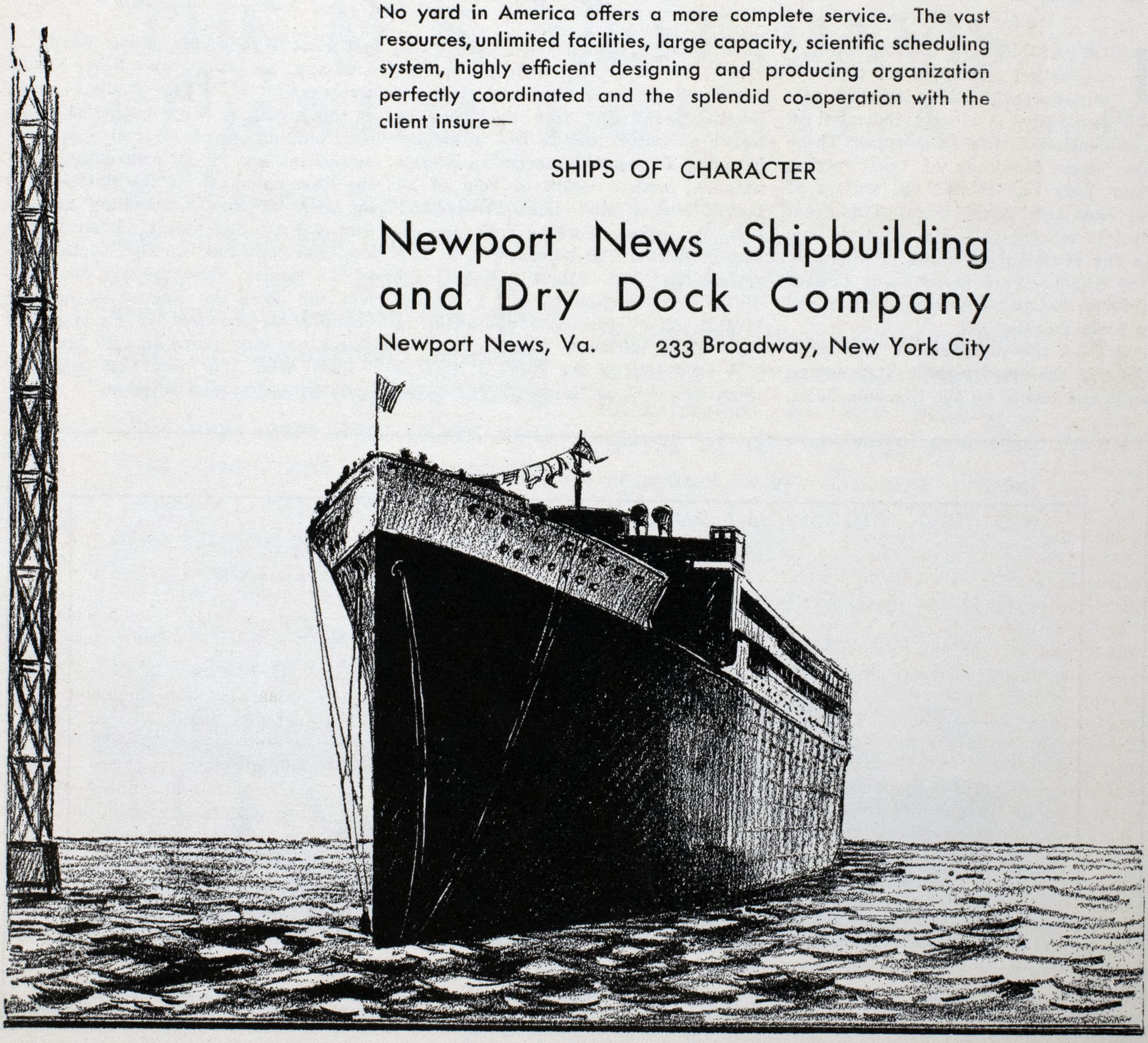

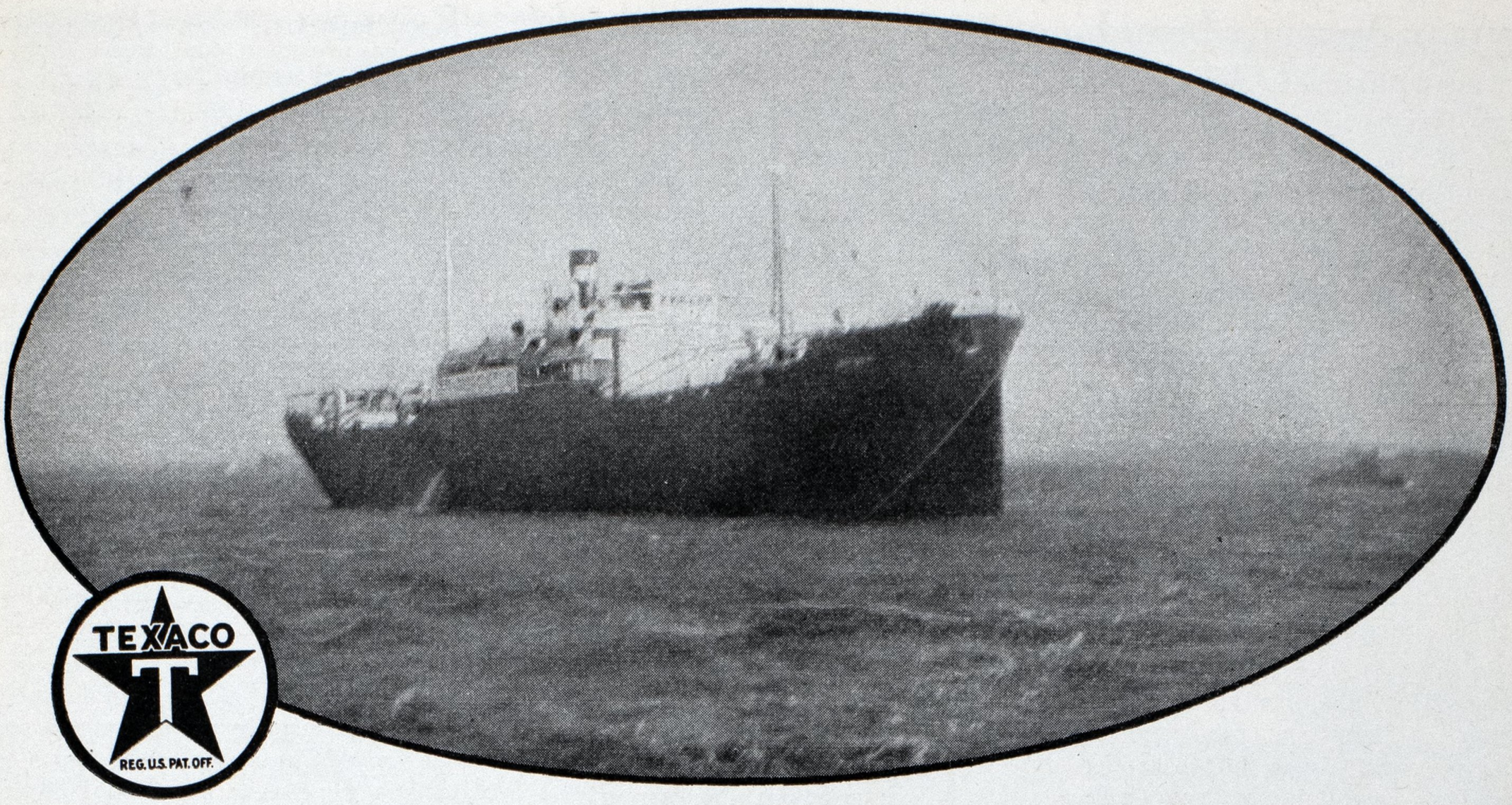

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Most effective lubrication is the rule of the engine room aboard the "Jeff Davis". Texaco Lubricants did their part by successfully lubricating the Diesel engines during the dock and sea trials and this vessel will now go to sea Texaco lubricated. This is also true of the sistership the M. S. "Potter".

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THE TEXAS COMPANY

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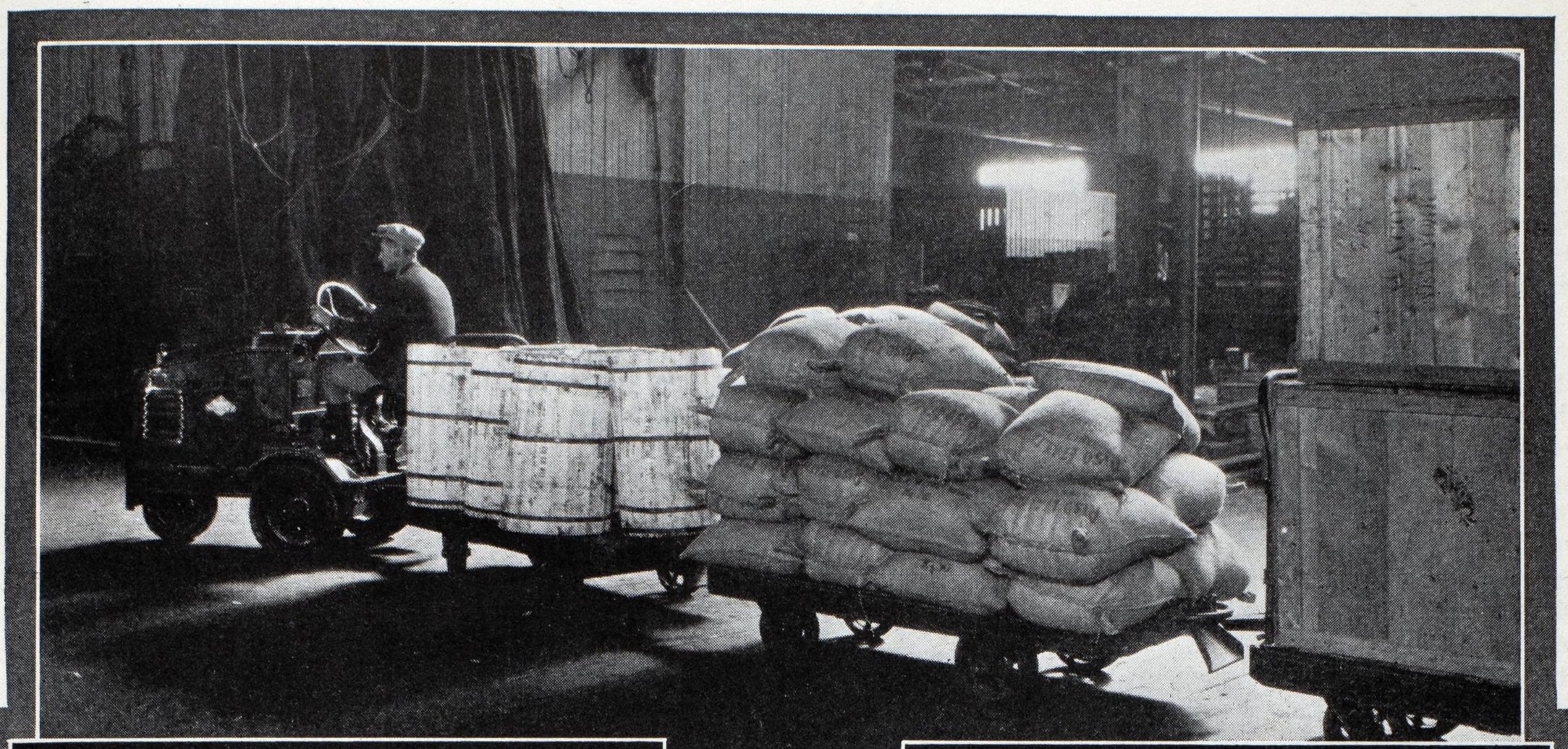

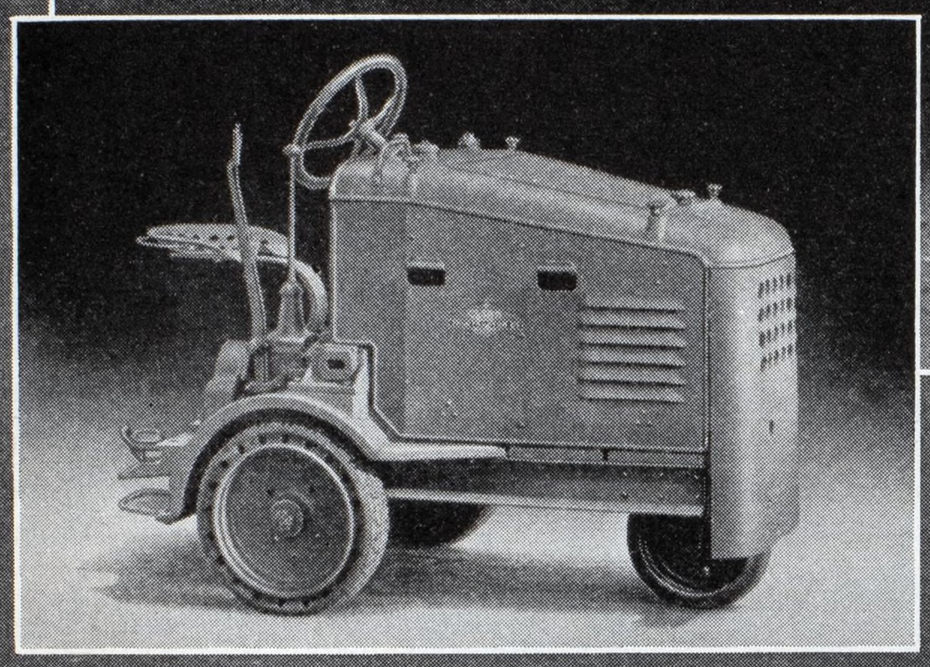

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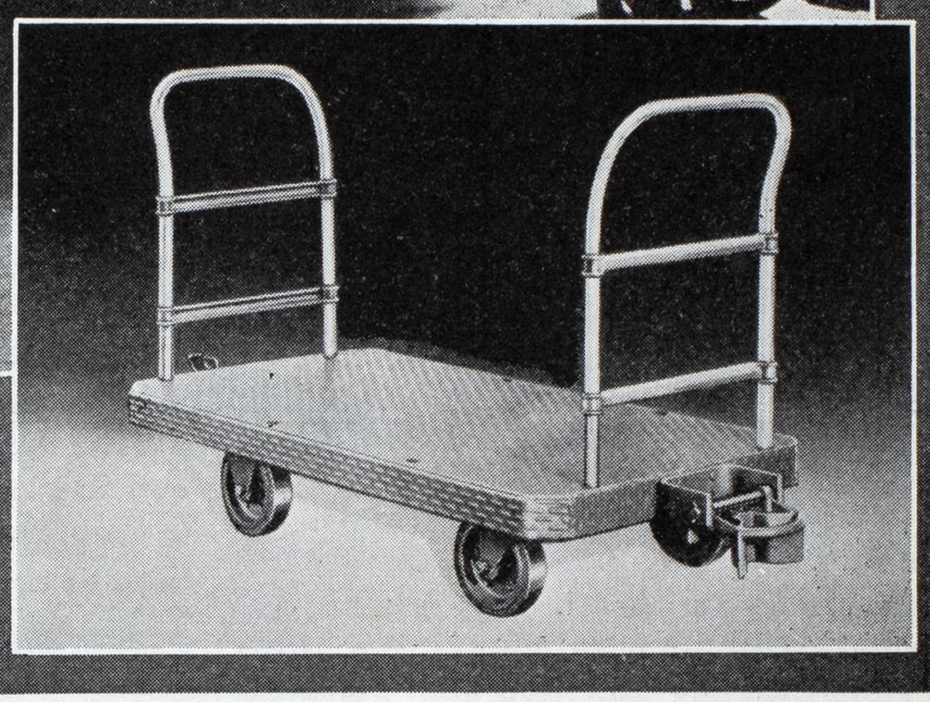

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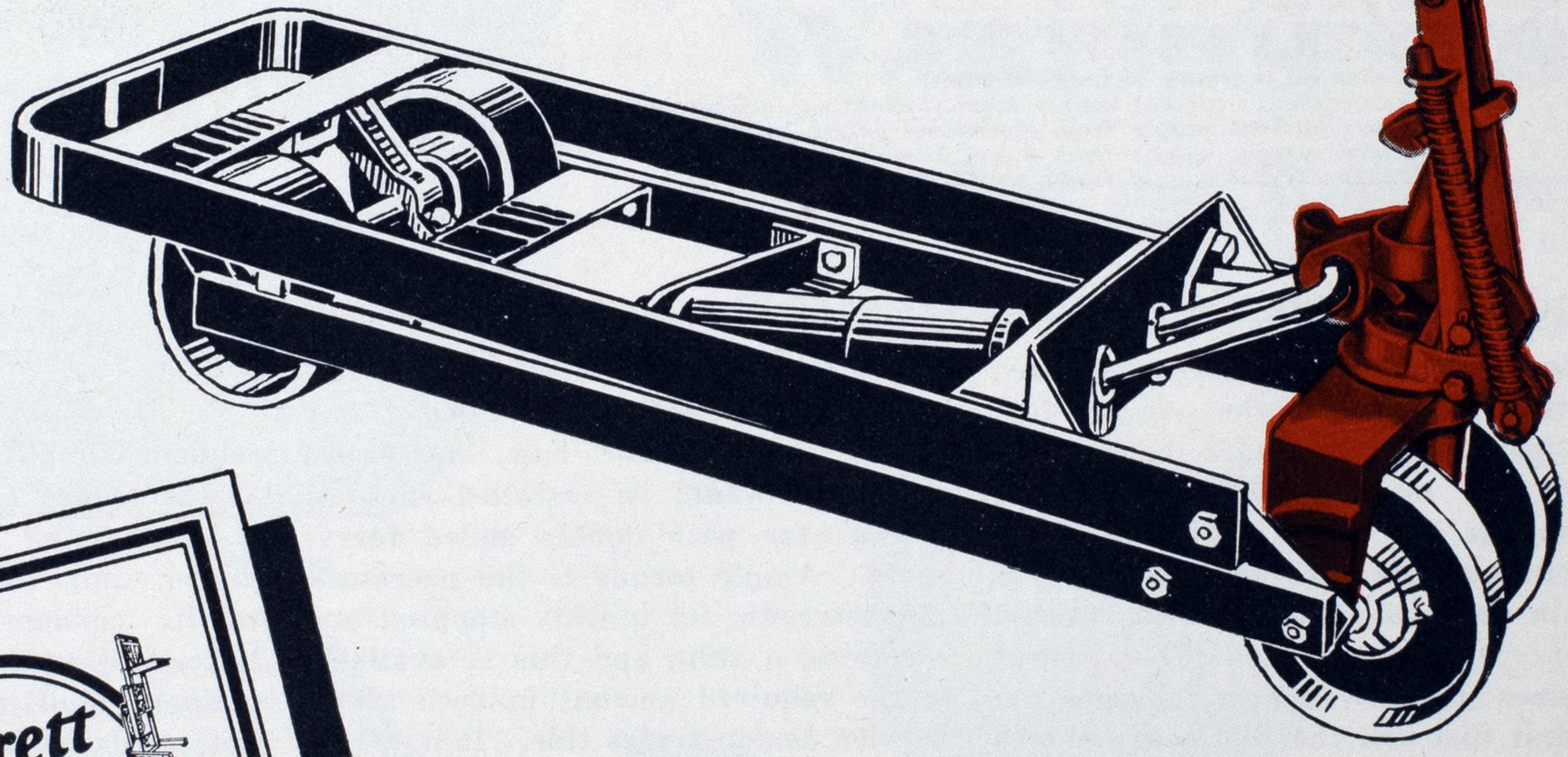

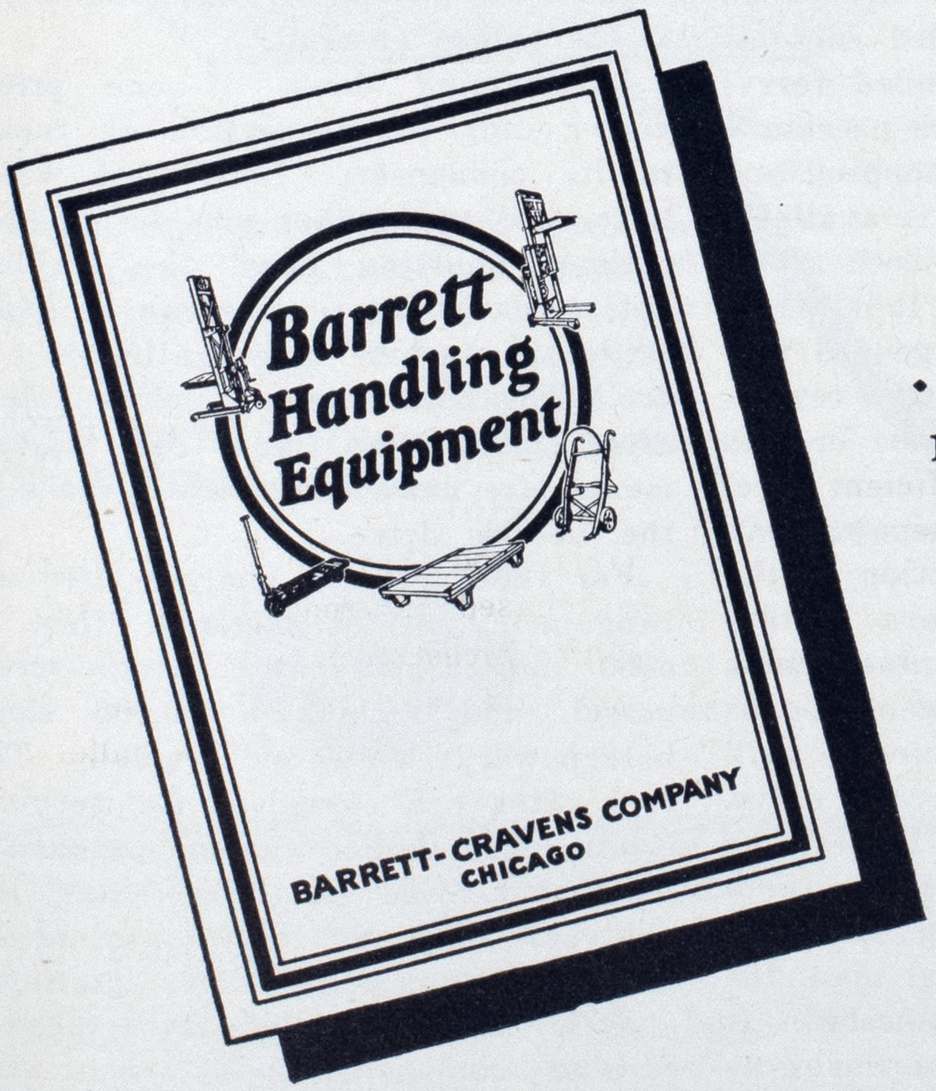

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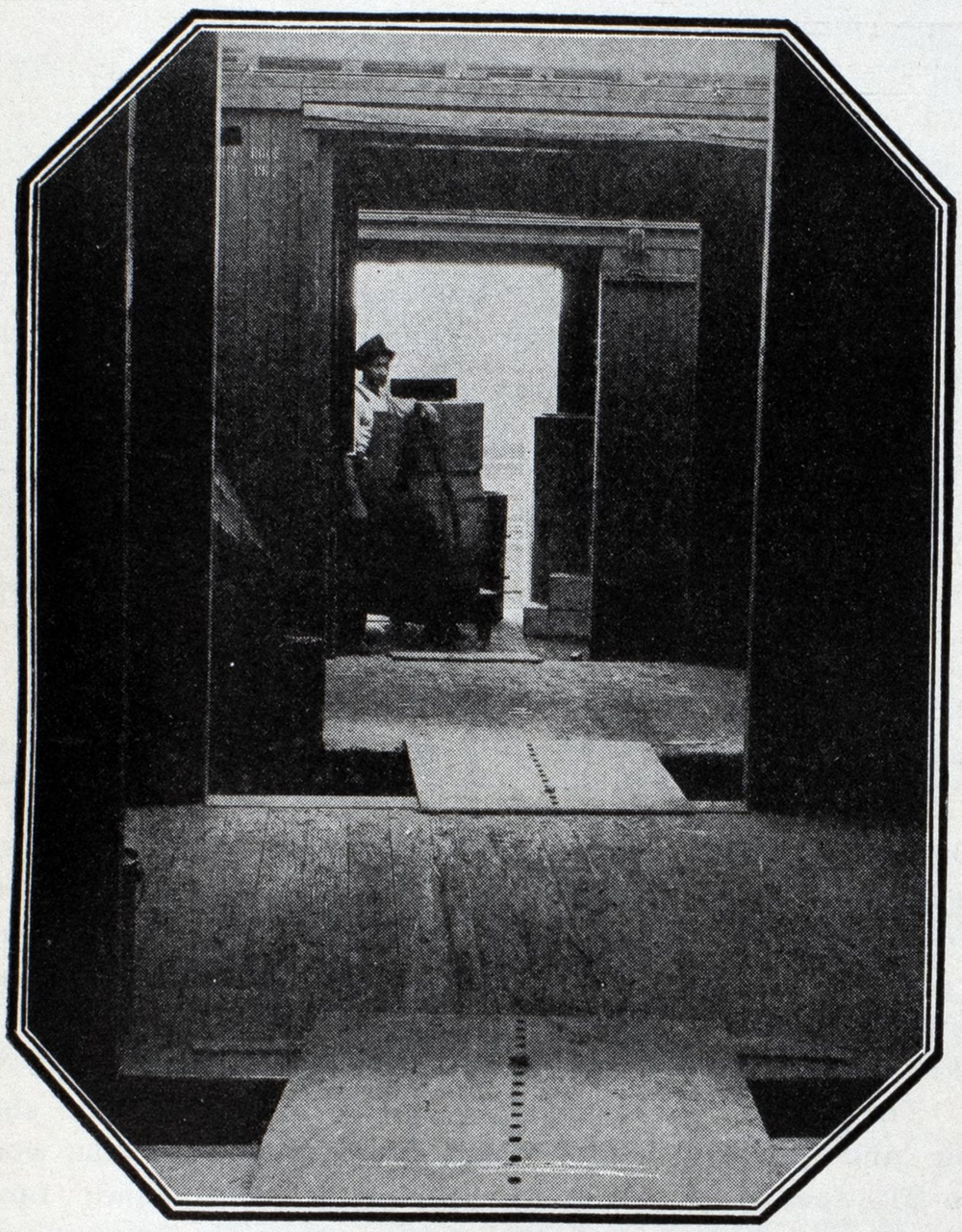

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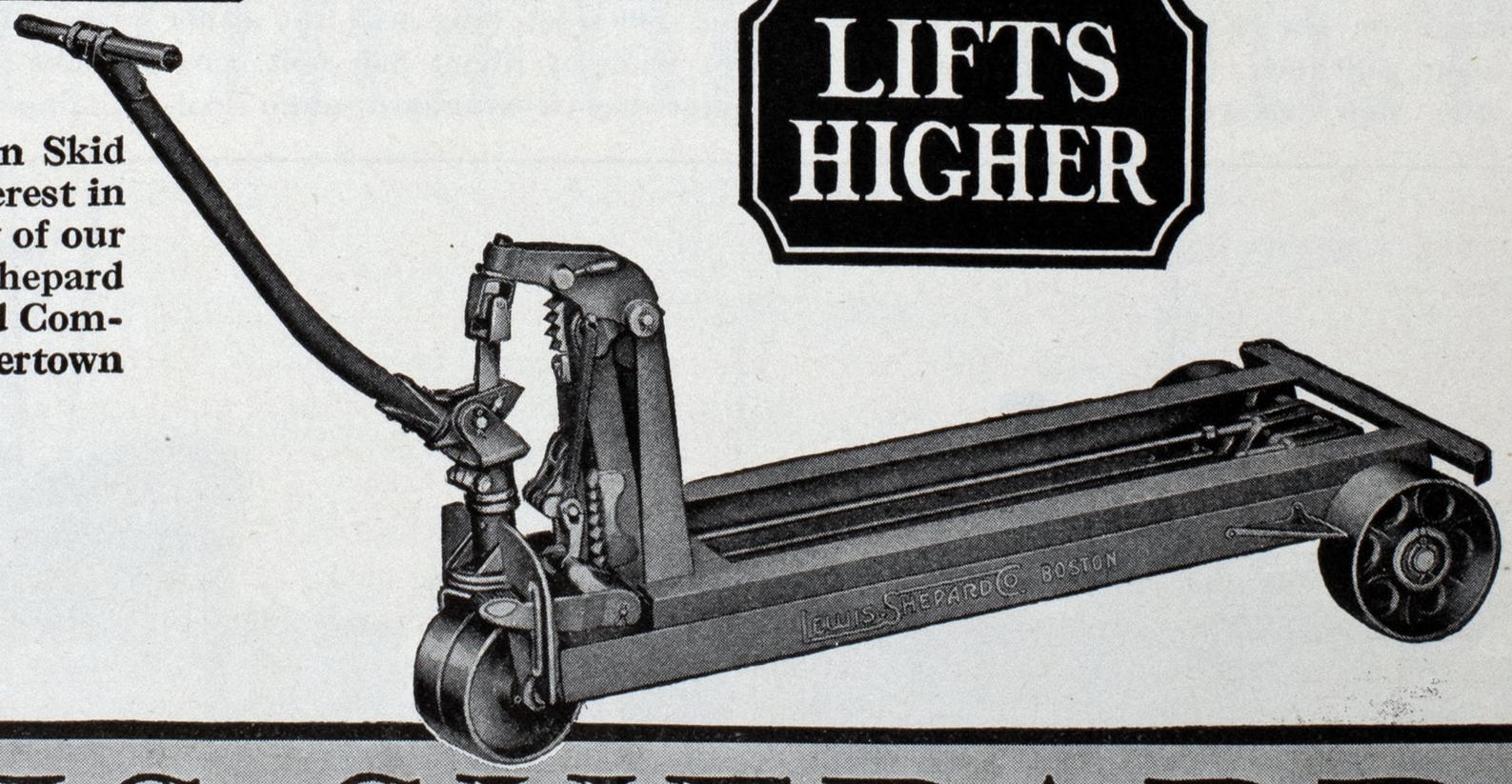

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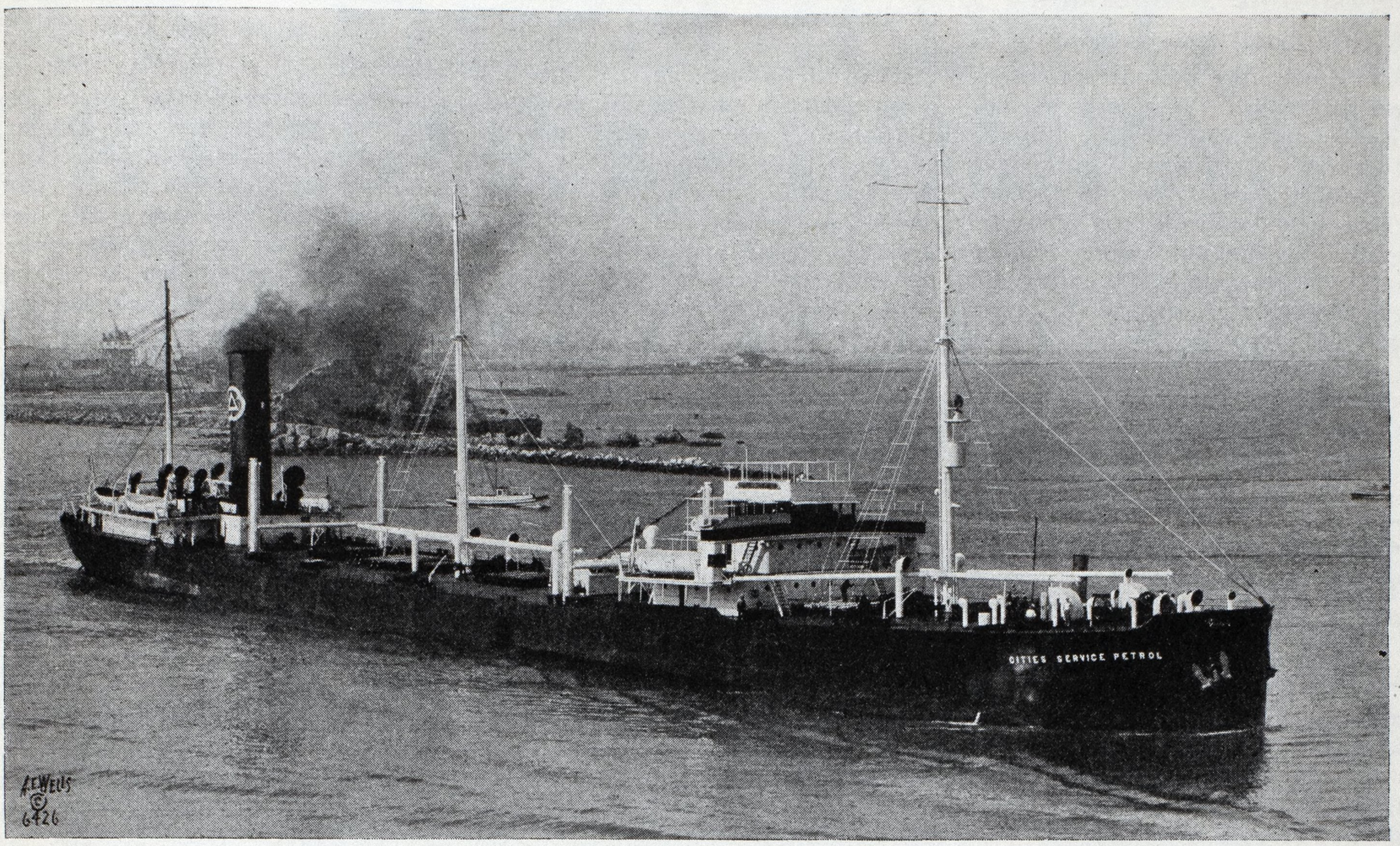

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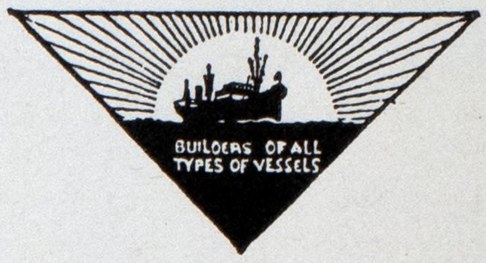

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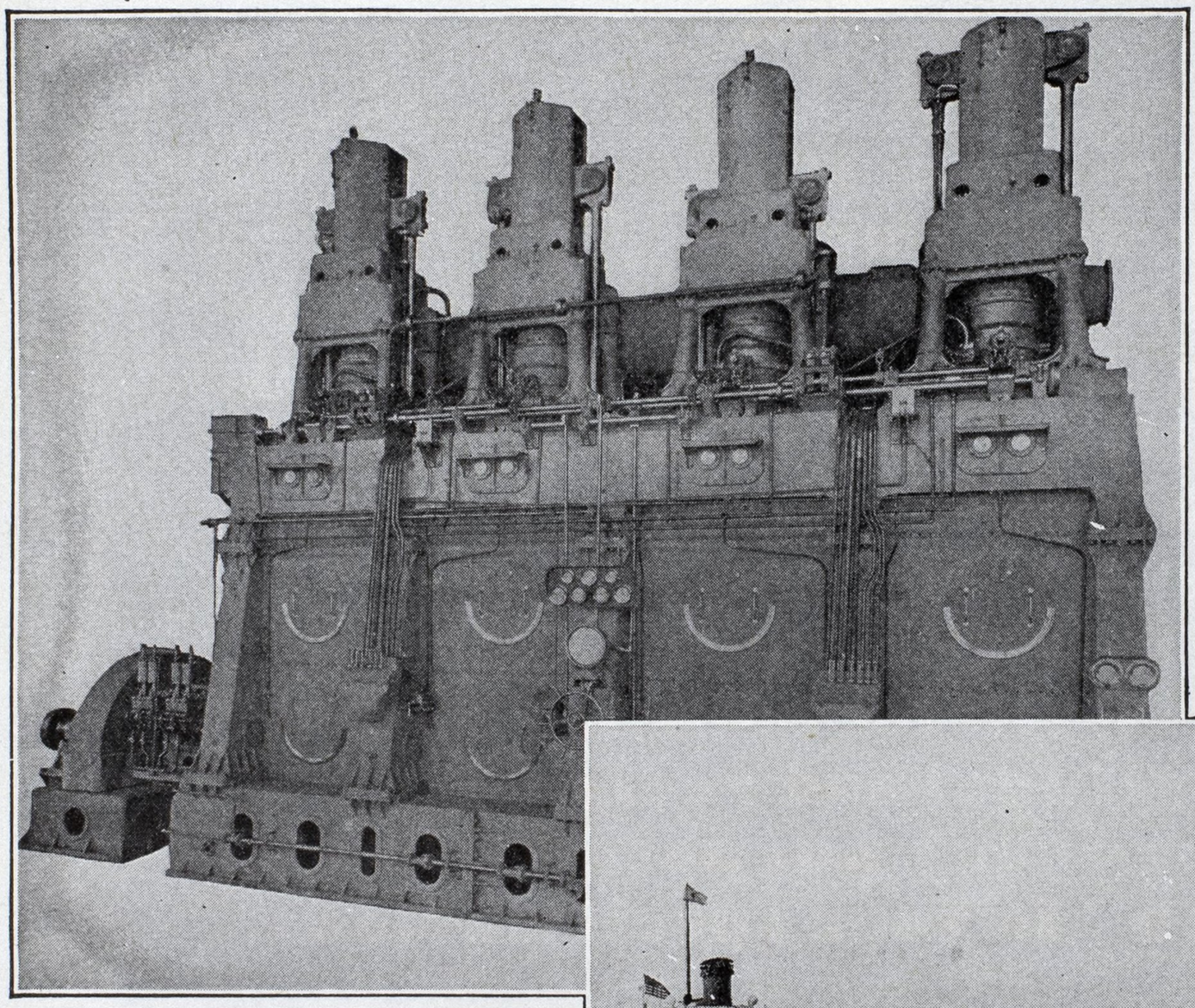

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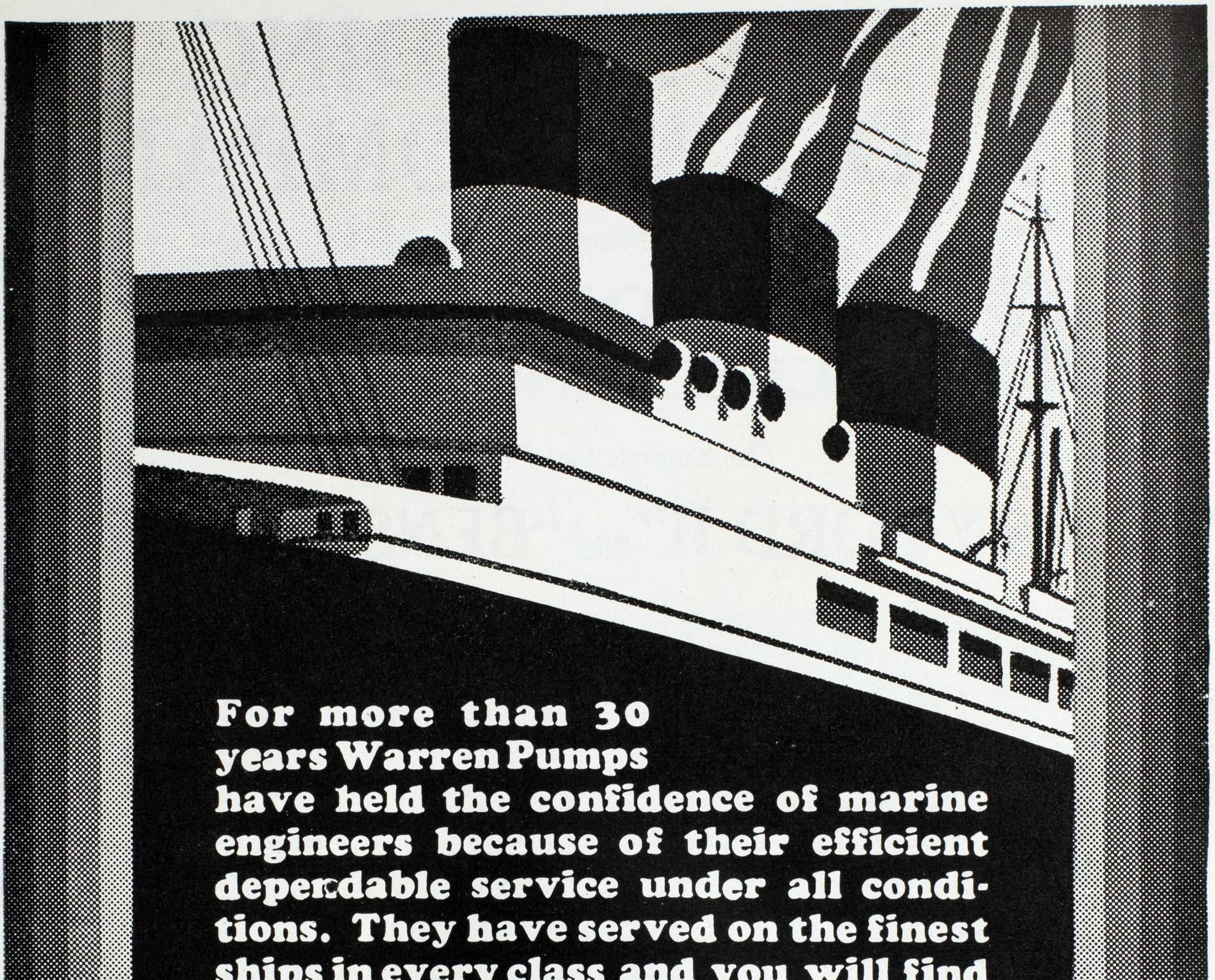

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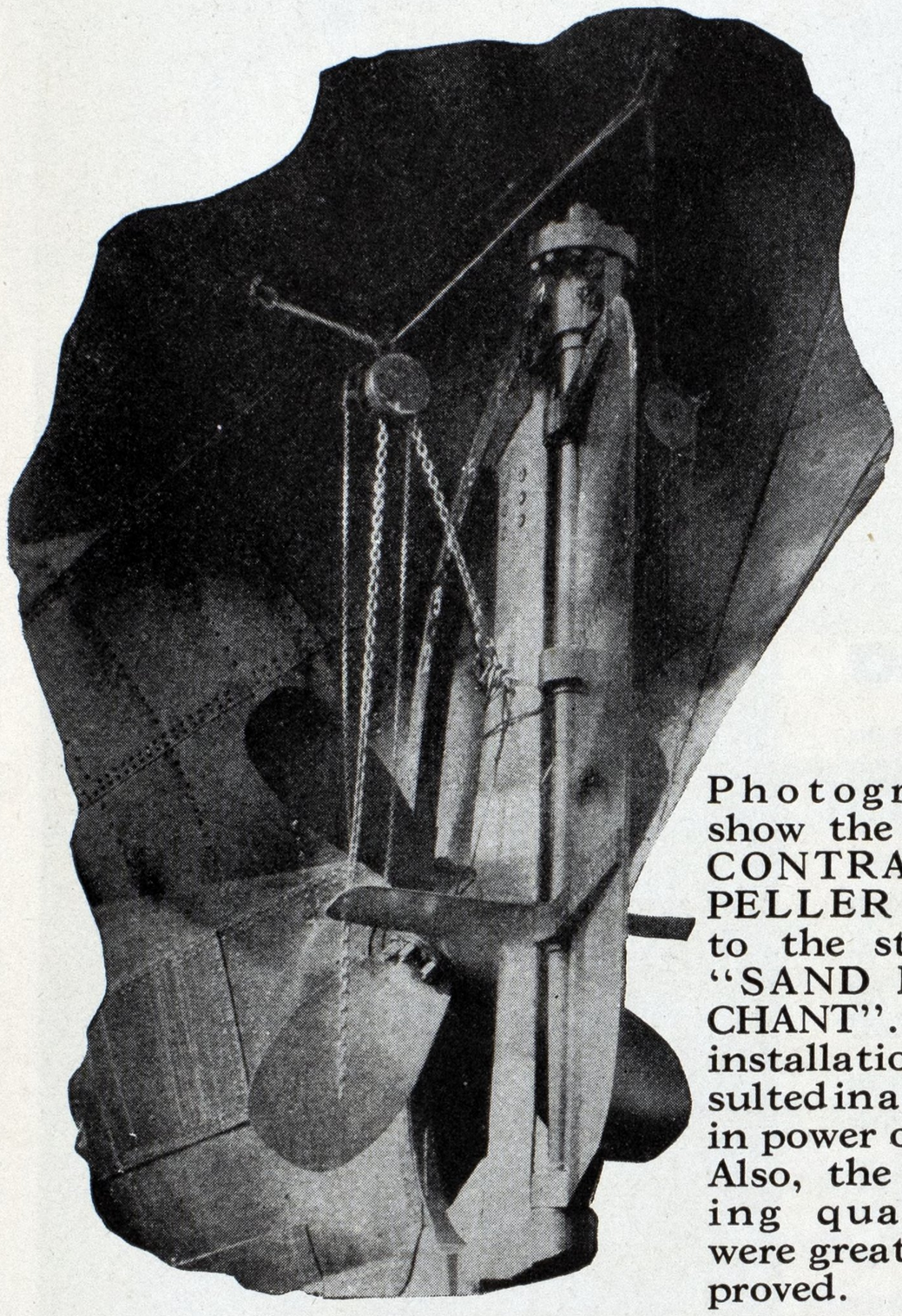
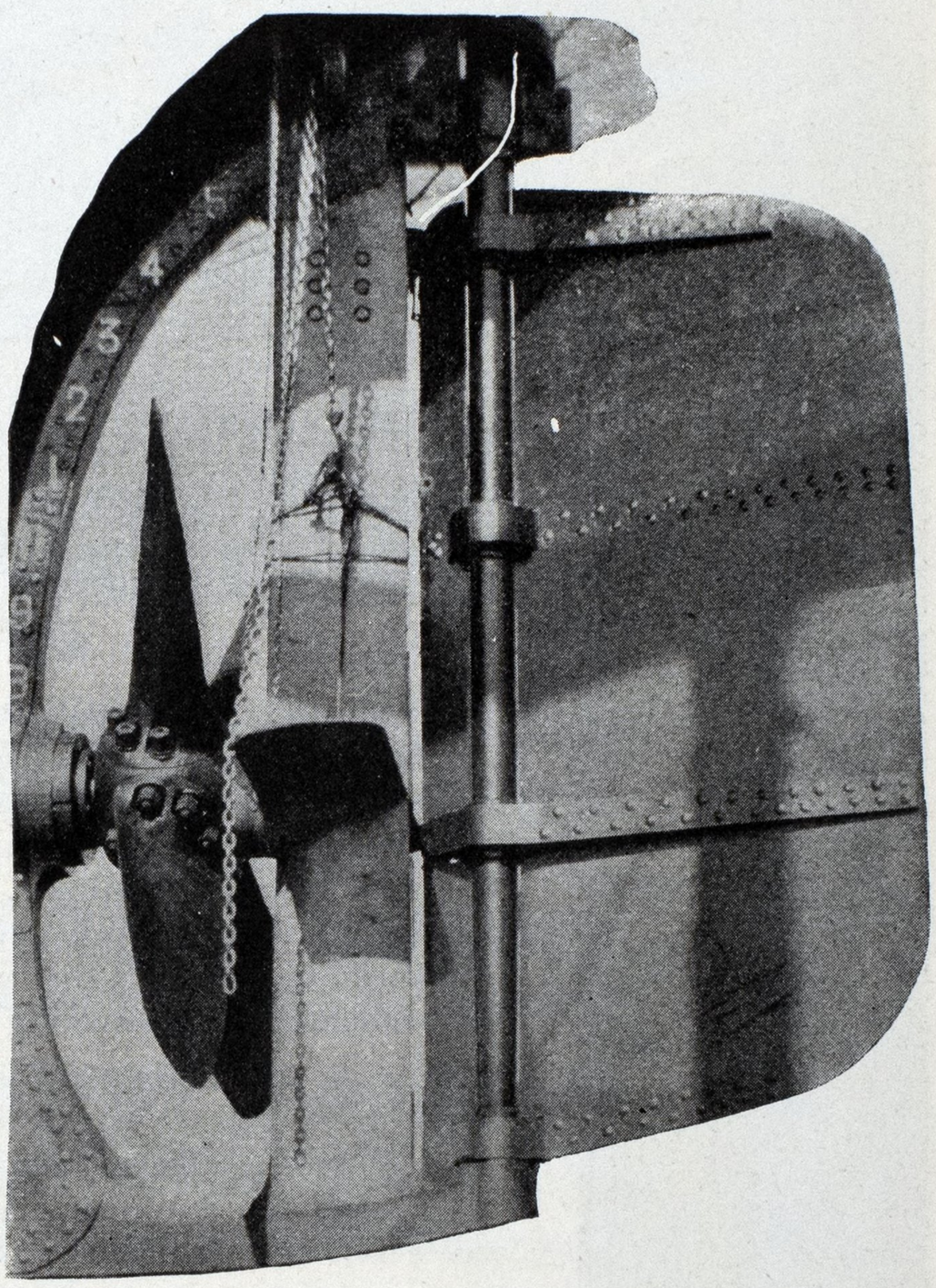
Collingwood, Ontario

Sole Licencees for Canada— for Star Contrapropellers and Rudders





Photographs show the STAR CONTRAPROPELLER fitted to the steamer "SAND MERCHANT". This installation resulted in a saving in power of 12%. Also, the steering qualities were greatly improved.

STAR CONTRAPROPELLERS have been fitted to 425 vessels representing 2,577,181 tons with an aggregate of 1,035,493 I. H. P.

The main advantages are:

Saving in power of from 10% to 15% for the same speed.
Increase in speed of from 5% to 10% for the same power.
Improved steering, which is important in handling ships in canals and narrow waterways.

Reduction in vibrations.
The Contrapropeller is applicable to all types of vessels.

PLANS AND ESTIMATES WILL BE FURNISHED ON APPLICATION

American Standards at Sea

When you sail in a United States liner you go abroad with the finest American living standards . . . your own accustomed cuisine . . . your own accustomed refinements in accommodations . . . your own language . . . American conveniences, American comforts. And these are so appreciated by the traveling American!

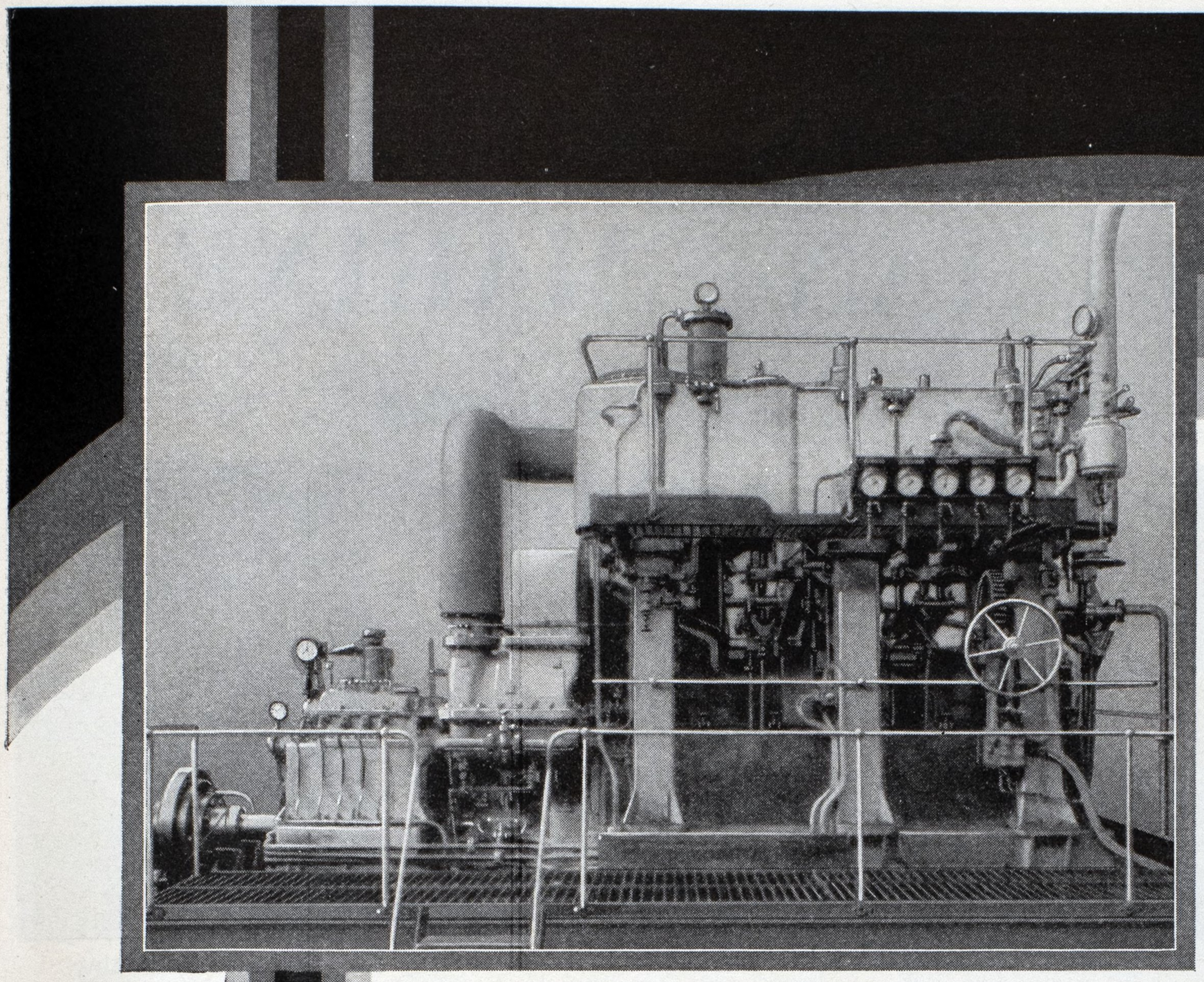
When you ship freight abroad via these lines—and the American Merchant Lines—you command the utmost in American marine efficiency and experience. That saves time . . . patience . . . and money.

See one of our many branches—or your nearest agent—for practical suggestions on travel or shipping between New York and England, Ireland, France and Germany.

The Fleet of Service

Leviathan, world's largest liner—swiftness with comfort! The George Washington, America, Republic, President Harding and President Roosevelt—superb cabin ships. And those dependable cargo vessels of the American Merchant Lines sailing weekly between New York and London direct . . . American Banker, American Farmer, American Merchant, American Shipper and American Trader, each of which carries a limited number of passengers.

UNITED STATES LINES



2013

Reciprocating Engines *made* ECONOMICAL

A DE LAVAL EXHAUST TURBINE installed to supplement a piston engine, in accordance with the Bauer-Wach System, will increase the power 20 to 25 per cent, or decrease the fuel consumption for equal power by a like amount.

Greater speed, more trips, and greater yearly earnings can be made without changing the existing boiler plant or burning more fuel.

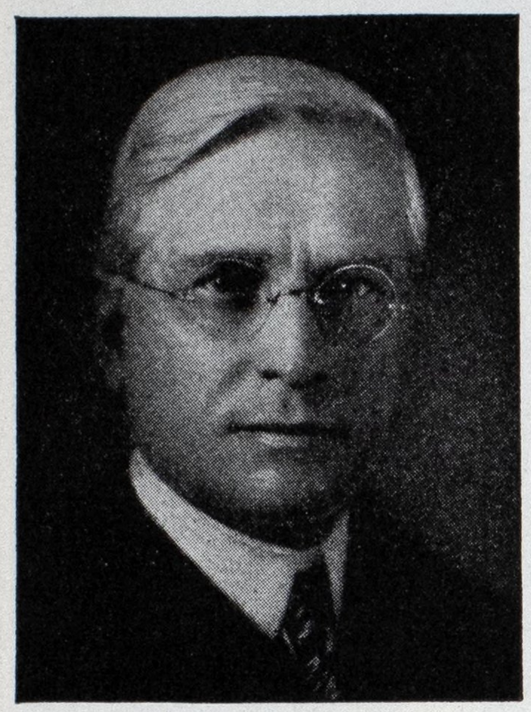
References can be given to 500,000 H. P. in successful service.

De Laval
Steam Turbine Co.
Trenton, New Jersey

THIS IS YOUR MERCHANT MARINE

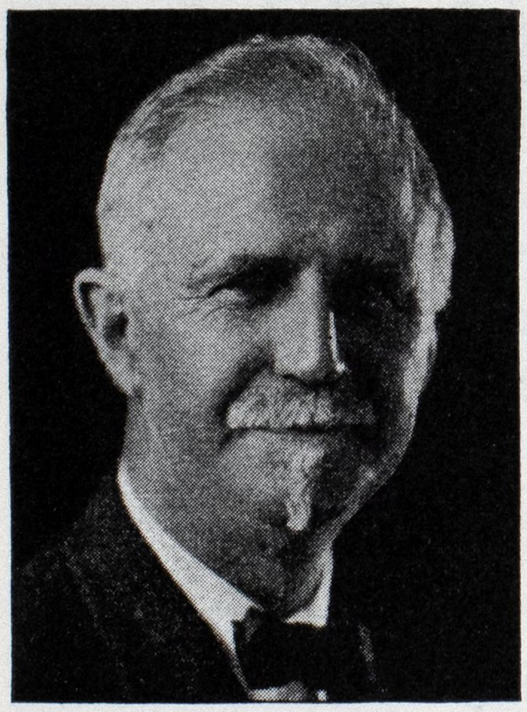
Built and maintained

FOR YOU



F. EDSON WHITE
President, Armour & Company

"A Merchant Marine is essential to the future welfare of the United States. We need and must have great fleets of steamers."



ROGER BABSON
Noted Business Lecturer and Writer

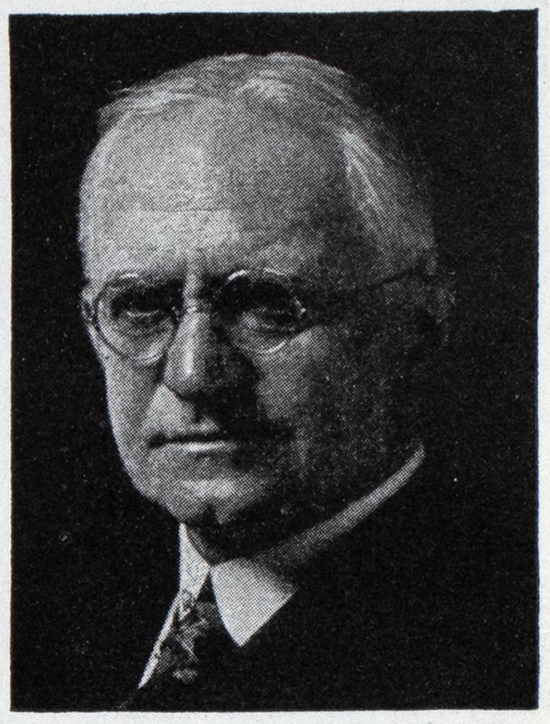
"Ship under the American flag. Our Merchant Marine is worthy of your support."

TO meet the gigantic post-war needs of our industries there has been built up in the United States a new Merchant Marine containing a great fleet of speedy, modern freight ships. Sailing to all parts of the world, these vessels offer an unrivaled opportunity for American Business to increase its foreign outlets and extend its overseas trade.

Realizing the vital importance of having American ships for American goods, many of the outstanding business men of the nation, among them such leaders as Harvey Firestone, George Eastman, F. Edson White and Roger Babson, urge you to use these vessels whenever you can and to take full advantage of the opportunities they offer.

The hundreds of vessels in the 18 lines owned by the United States Shipping Board and those in the many lines developed by the Shipping Board but now under private ownership provide the utmost in safe, speedy and economical freight transportation. An added service available to users of the Shipping Board lines is found in the advice and counsel of their experienced American operators. These experts will be glad to help you work out any problems pertaining to transportation needs.

Write for full information about ships, rates, dates of sailing, etc.



GEORGE EASTMAN
Chairman of the Board
Eastman Kodak Company

"The splendid services rendered by the American Merchant Marine deserve the support of American business."

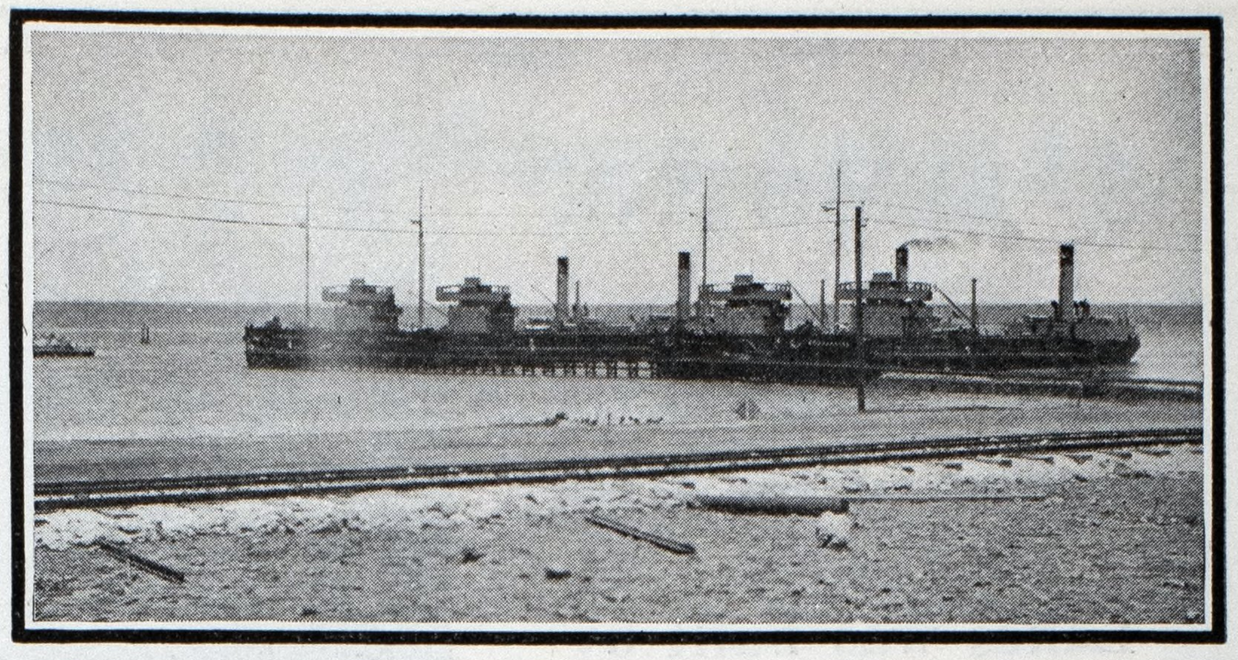
HARVEY FIRESTONE
President, Firestone Tire and Rubber Co.

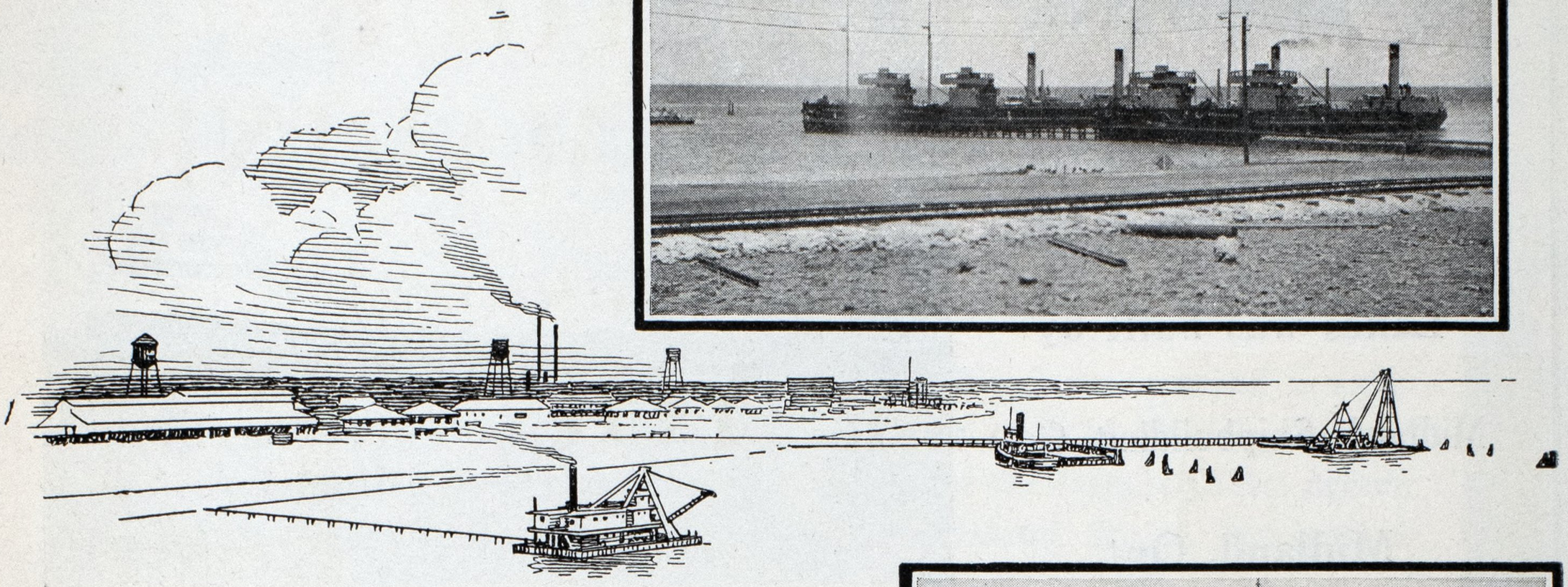
"We can have a strong American Merchant Marine only by using American-flag ships."

UNITED STATES SHIPPING BOARD MERCHANT FLEET CORPORATION

WASHINGTON, D.C.

Looking toward the breakwater, showing the tanker pier for lake vessels.



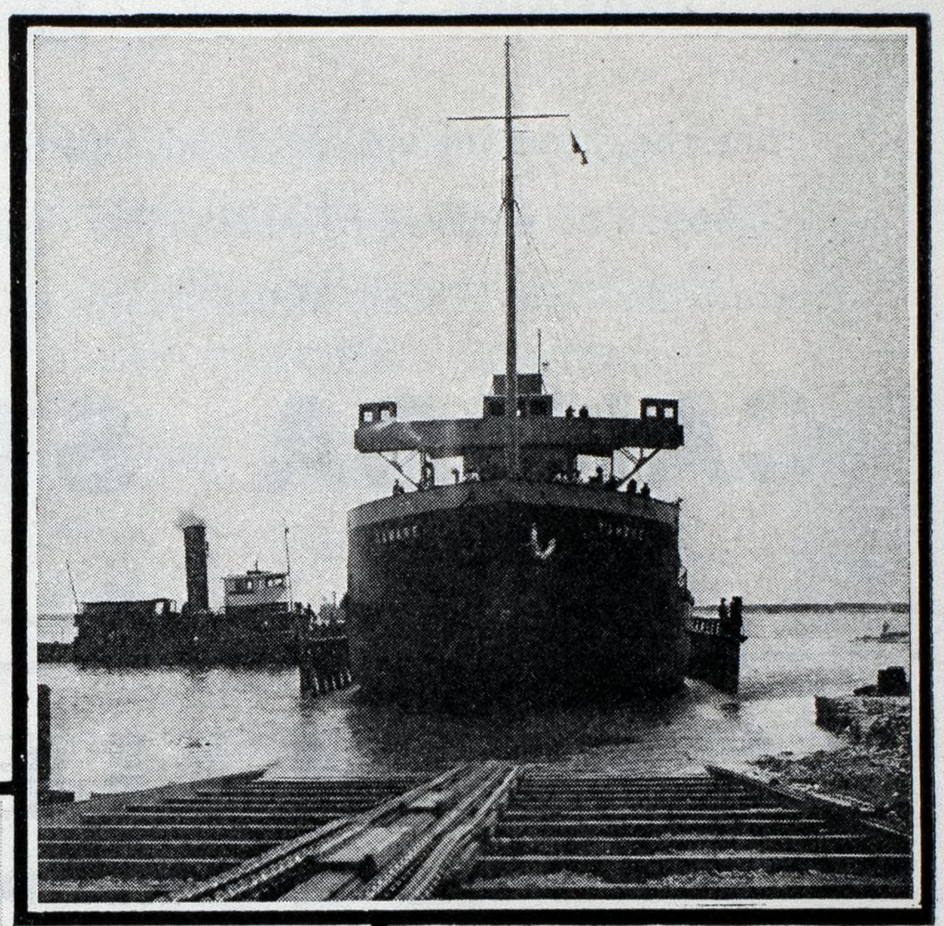


At St. Nicholas Bay, Aruba, D. W. I., Crandall Engineering has erected a Dry Dock, Breakwater, and Piers

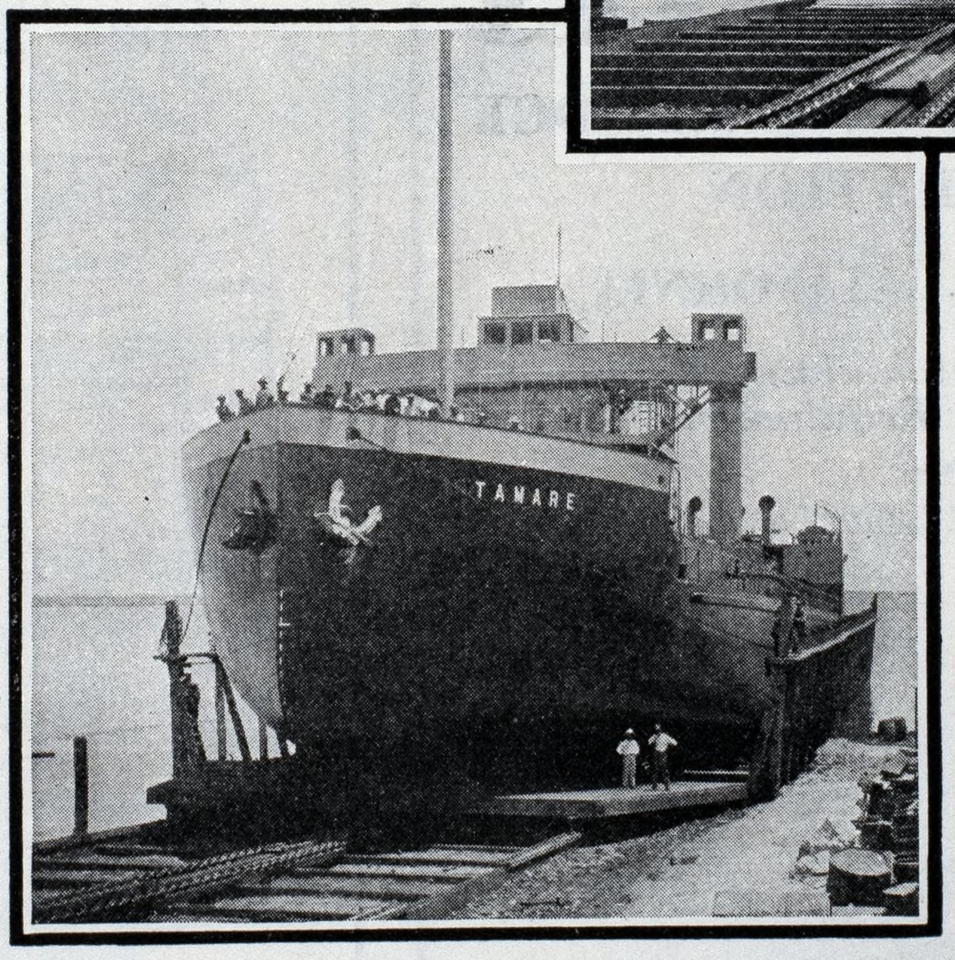
ARUBA in the Caribbean is one of the leading oil handling centers of the world. To this island come the light draft vessels from Lake Maracaibo in Venezuela, with crude petroleum for the refineries and for transfer to ocean tankers.

At St. Nicholas Bay we erected a Crandall Railway Dry Dock, two piers, and a breakwater for the Lago Oil and Transport Co., Ltd. and the Pan American Petroleum & Transportation Company, subsidiaries of the Standard Oil Company of Indiana. The location made it necessary to import all skilled labor and materials.

Our organization specializes in sub-aqueous work and is prepared by experience and equipment to plan and build in any part of the world. We are always available for consultation.



S. S. Tamare being docked in Crandall Railway Dry Dock.



Crandall Railway Dry Dock, with vessel resting on the cradle, entirely free of the water.

THE CRANDALL ENGINEERING CO.

DRY DOCKS
BRIDGES
PIERS

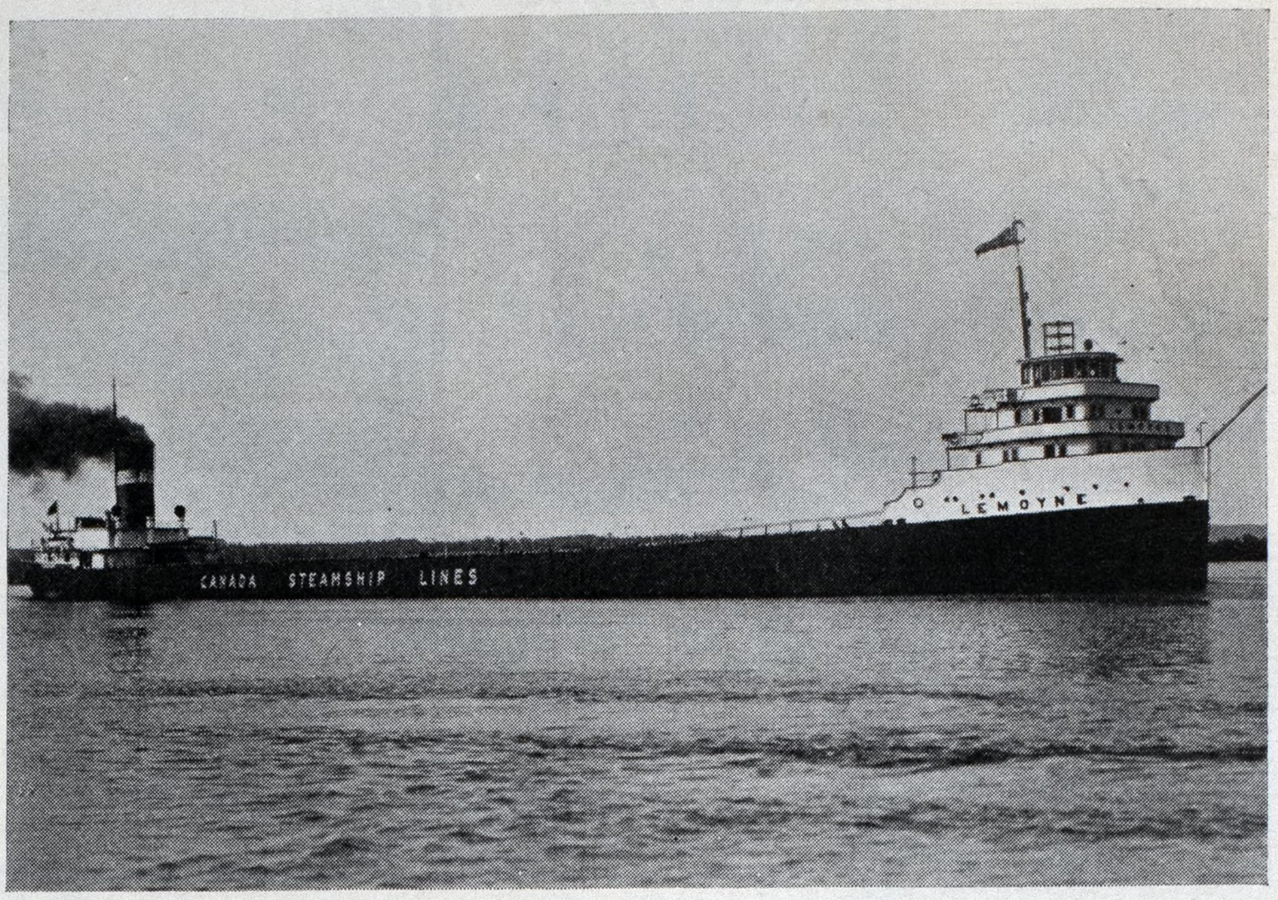
Cambridge SINCE 1854 *Massachusetts*

SS "LEMOYNE"

Record-breaking bulk freighter of the Upper Lakes was built by

Midland Shipbuilding Co.,

Midland, Ont.



From the yards of the Midland Shipbuilding Co., have been launched some of the greatest bulk freighters and package freighters now operating on the Great Lakes. SS "LEMOYNE" holds world records for Rye, Wheat, Mixed Grains and Coal. Midland Shipbuilding Company is owned by

CANADA STEAMSHIP LINES

LOS ANGELES

SHIPBUILDING & DRYDOCK CORPORATION

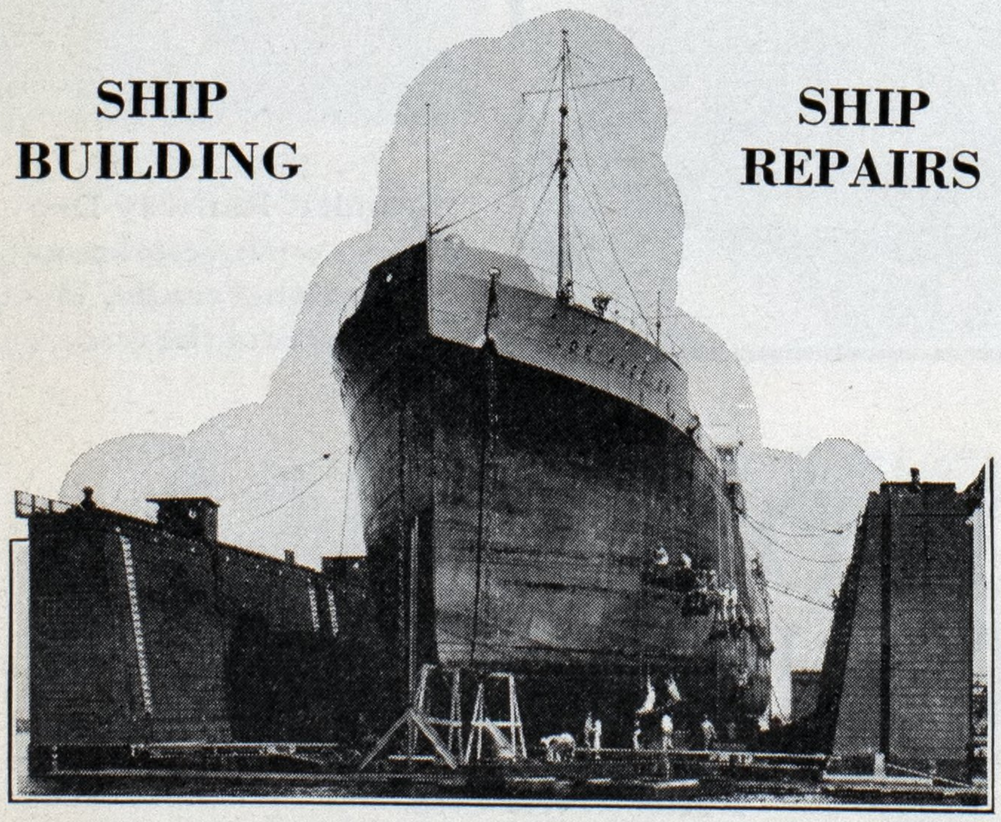
SAN PEDRO, CALIFORNIA

40 Acres of Modern Shipbuilding Equipment To Meet Every Requirement

Floating Drydock—12,000 Tons Capacity

SHIP BUILDING

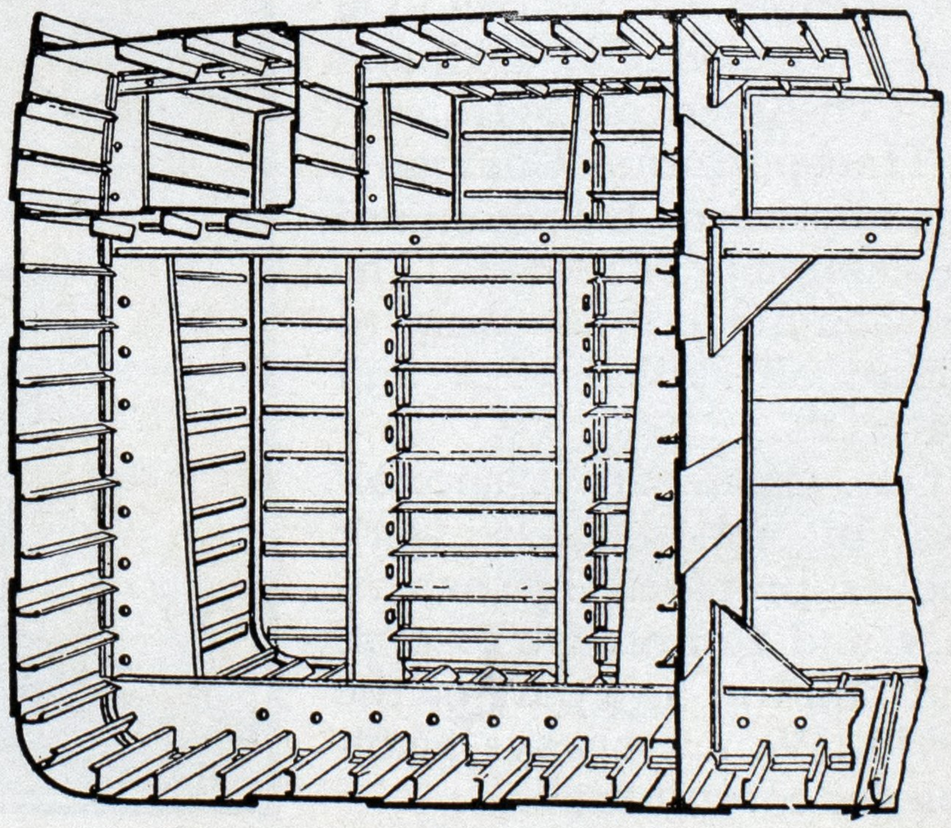
SHIP REPAIRS



Progress in Oil-Tank Ship Construction

The "Bracketless-System"

(PATENT)



Eliminates Bulkhead Brackets
Eliminates Bulkhead Leakage
Greatly Simplifies Construction
Greatly Reduces Cost of Damage Repairs
Greatly Reduces Cost of Cleaning Tanks
Substantially Increases the Longitudinal Strength
Beyond the Well-tried "Isherwood System"

Shipowners are advised to specify that plans and structural arrangements should be approved by

SIR JOSEPH W. ISHERWOOD & CO., Ltd.

17 BATTERY PLACE, NEW YORK
and 4, LLOYD'S AVENUE, LONDON, E. C. 3

1

Another modern tug is added to the F-M Diesel fleet in Hawaii

Large, modern and amply powered, the "Eleu" has proved a valuable addition to the steadily growing fleet of F-M Diesel powered tugs in Hawaiian waters. This boat—one of the largest Diesel driven tugs in the world—is used by the Inter-Island Steam Navigation Co. for general towing service.

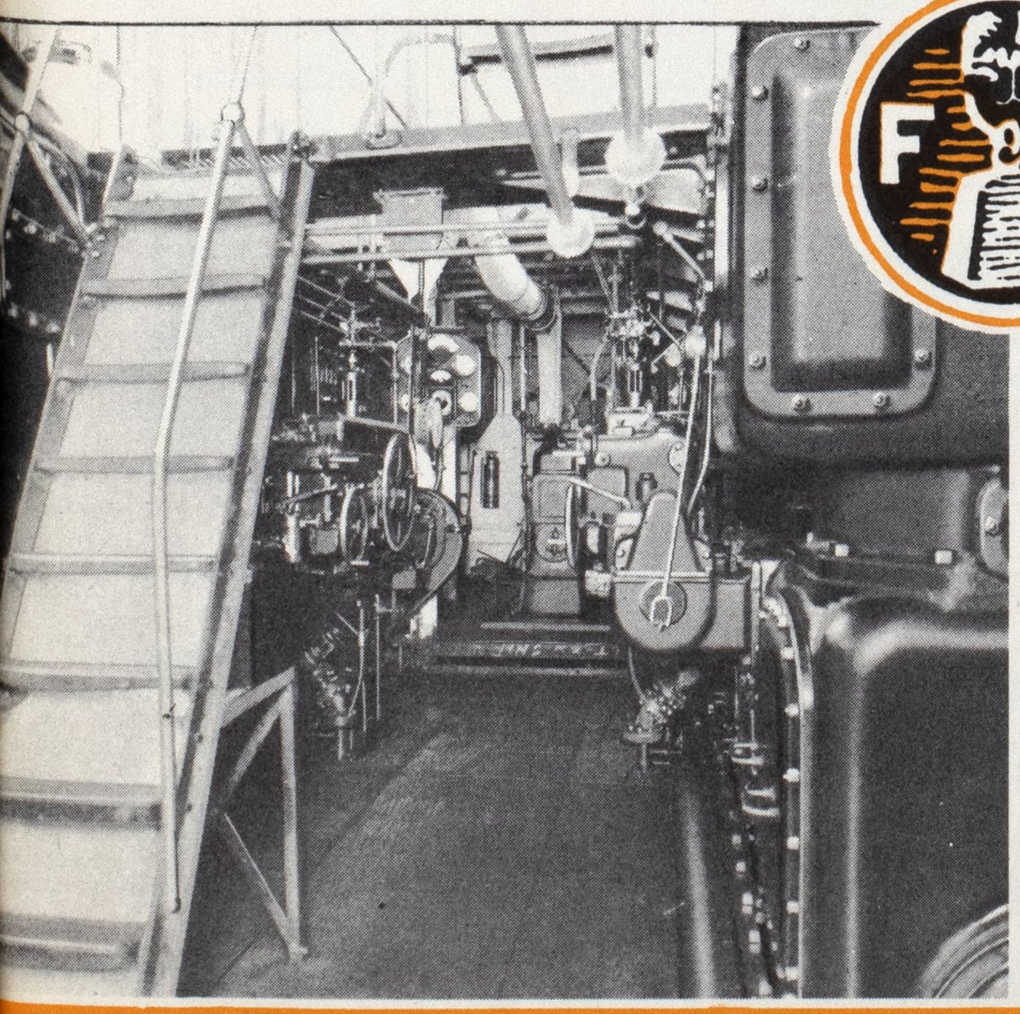
The "Eleu" is powered with two 560 hp. two cycle, airless injection F-M Diesel Engines which are direct connected to twin screws. A 60 hp. F-M Diesel drives a 2-stage compressor and a 40 kw., 125 volt F-M Generator which supplies the current for electrified auxiliaries.

In dependability, economical operation and easy handling, the "Eleu" has already established herself as a worthy companion of the ten other F-M Diesel powered tugs which are being used in these waters.

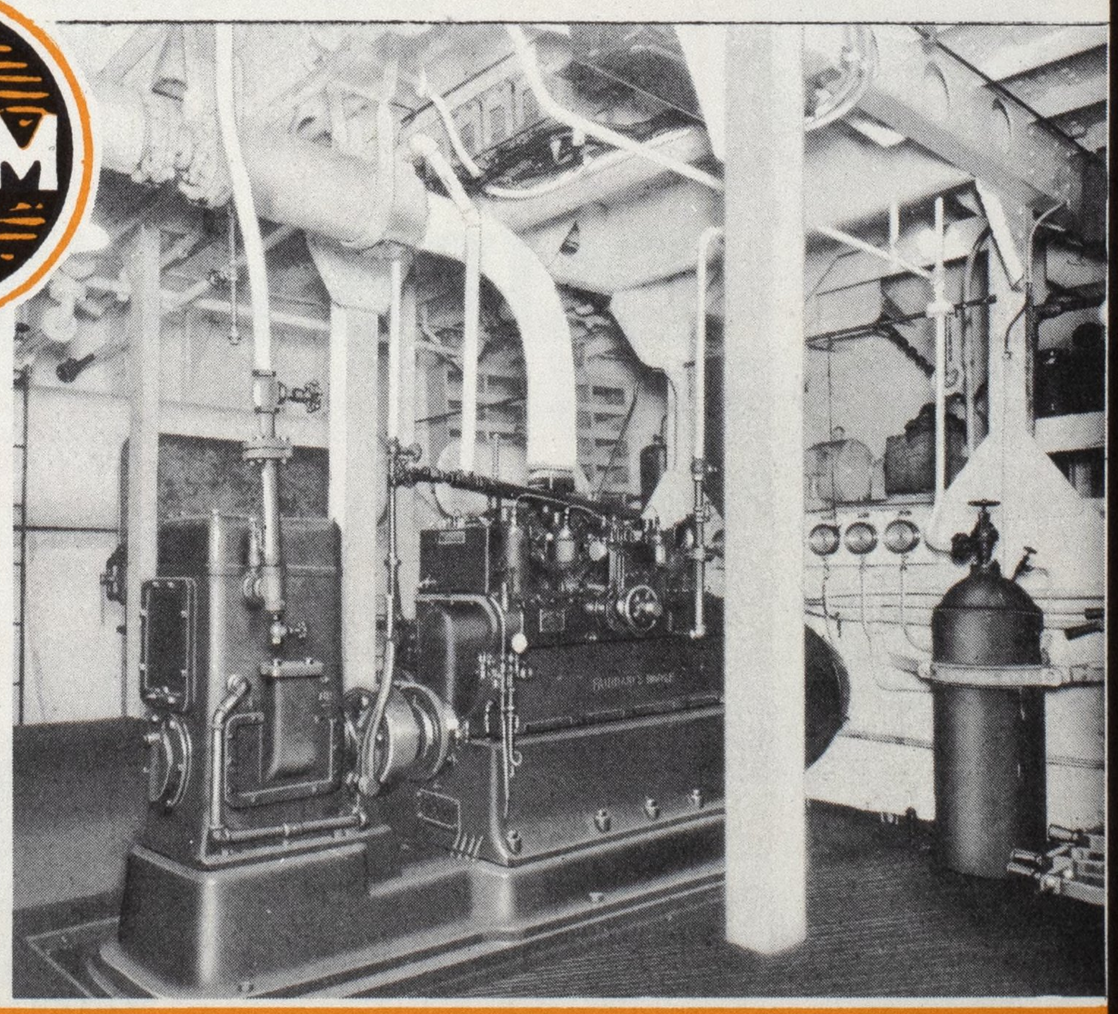
FAIRBANKS-MORSE

DIESEL ENGINES

POWER, PUMPING AND WEIGHING EQUIPMENT



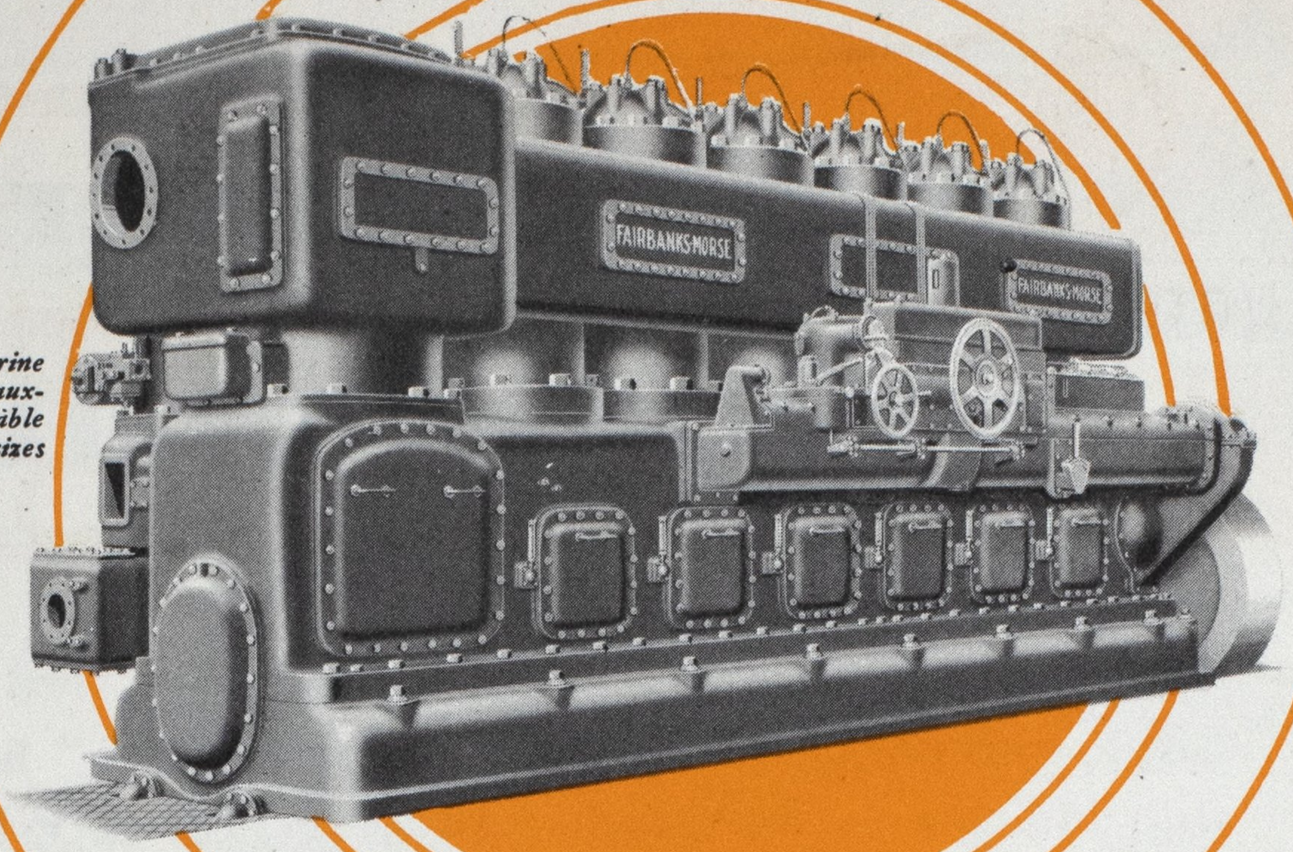
The engine room of the "Eleu," showing the two 560 hp. F-M Diesels



The 60 hp. F-M Diesel Engine which drives a 40 kw. F-M Generator and a 2-stage compressor

FAIRBANKS-MORSE DIESEL ENGINES

FAIRBANKS-MORSE DIESEL ENGINES



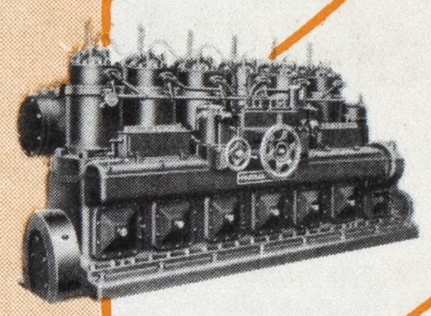
An 840 hp. F-M Marine Diesel with built-in auxiliaries. Also available in 700 and 560 hp. sizes

UNIQUE in the field of marine power equipment is Fairbanks-Morse service. A complete line of Diesel engines in many sizes from 25 hp. to 840 hp. meets the power requirements of most types of craft and makes available the economies of these engines for both the main drive and auxiliaries. Many marine builders and owners are taking advantage of unified responsibility and equipping their vessels with F-M Diesels, Motors, Generators and Pumps—all made in Fairbanks-Morse plants. Thus a single source of supply becomes responsible for efficient performance from the propeller shaft drive to electric lights, pumps and motor operated auxiliaries.

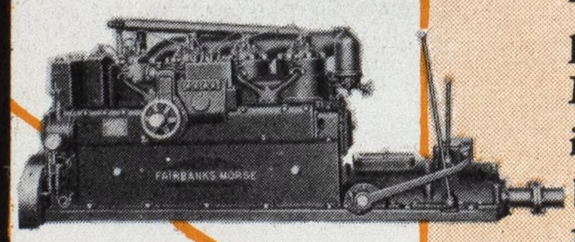
In the conversion of existing vessels or the building of new ones, F-M engineers are frequently called into consultation regarding power requirements.

The advantages of full Fairbanks-Morse equipment are further enhanced by service facilities in principal ports of the world—seldom is a Fairbanks-Morse-equipped vessel beyond the reach of F-M service. Fairbanks-Morse service facilities are unequaled by those of any other American manufacturer of Diesel Engines.

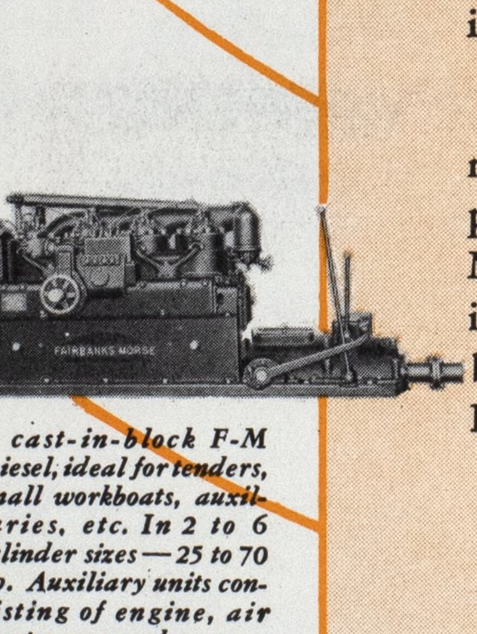
FAIRBANKS, MORSE & CO., Chicago
Branches with Service Stations in Principal Ports



A 240 hp. F-M Diesel built also in 3 to 6 cylinder types ranging from 75 to 360 hp.



A cast-in-block F-M Diesel, ideal for tenders, small workboats, auxiliaries, etc. In 2 to 6 cylinder sizes — 25 to 70 hp. Auxiliary units consisting of engine, air compressor and generator are also available



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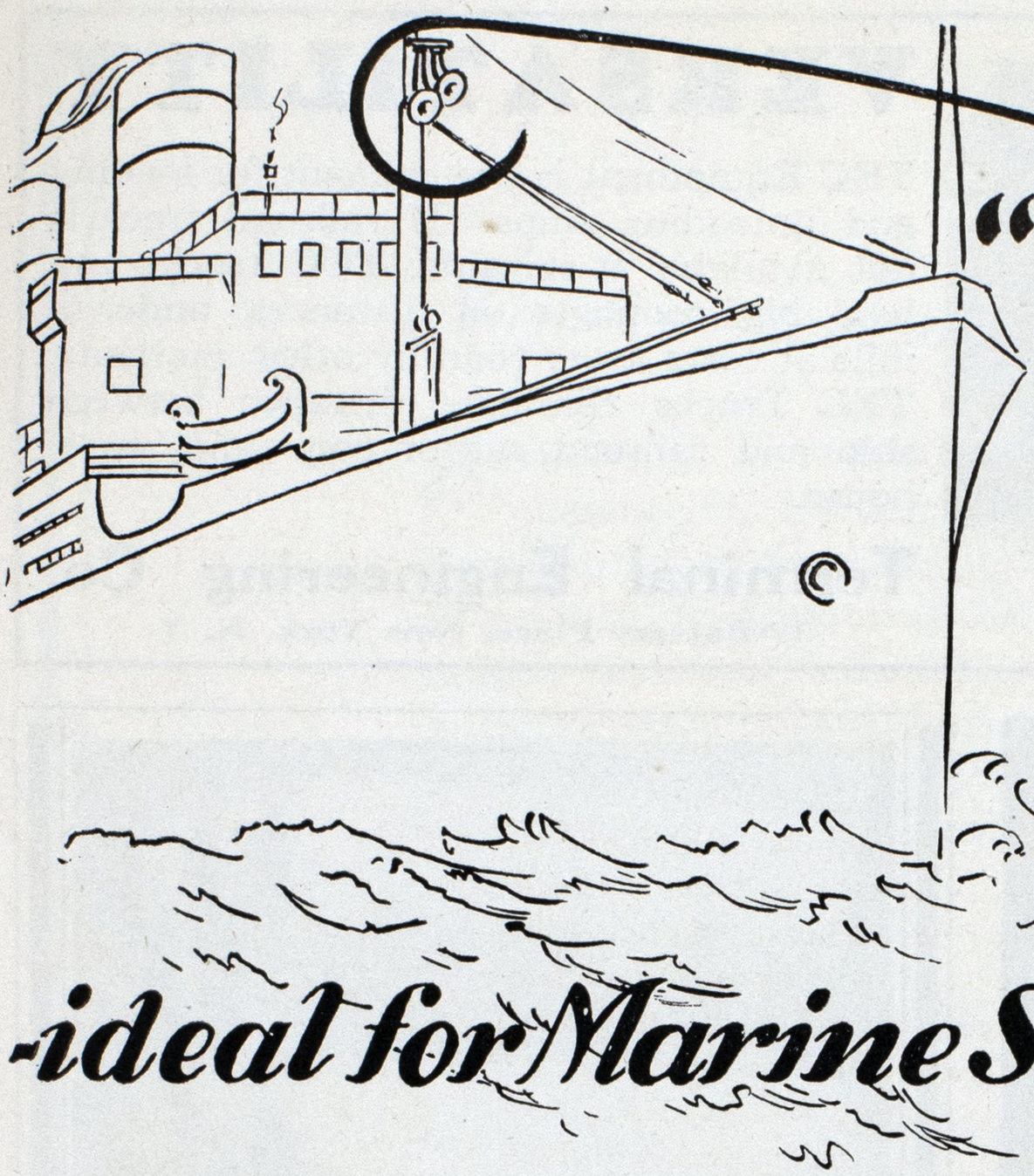
FAIRBANKS-MORSE
DIESEL ENGINES



Westinghouse "PNEUPHONIC" HORNS-

-ideal for Marine Signals

THE Westinghouse "Pneuphonic" Horn is a compressed air alarm signal of distinctive character.

Vibrations of a counterbalanced metal diaphragm release air waves which are greatly amplified by resonance in the bronze bell—producing a pleasing sound of tremendous carrying power with very low air consumption. The deep tone signal is clearly audible at a great distance, but produces no ear-splitting annoyance at close range.

Successful operation is obtained on air pressures up to 140 lbs. by direct connection, and on high pressure supply through a reducing valve. Manipulation is by means of a lever valve and cord, or by a magnet valve and electric switch.

The horns are sturdy and durable, with the vibrating unit enclosed in a substantial weatherproof housing. They are easily installed, need no adjustment, and require no attention.

The "Pneuphonic" is available in single tone or chime design of two, three or more horns, straight or curved bell. Used on tugs, ferries, yachts, and other craft, this horn commands attention by its distinct harmonious signal.

The large multiple horn combination installed in lighthouses or on shore produces a powerful penetrating fog signal, audible for many miles.

We also make a line of air compressors, in sizes from 3 to 700 cu. ft. displacement, both steam- and motor-driven, used extensively aboard ship and ashore, to start Diesel engines, operate scaling hammers, air whistles, and pneumatic tools.

WESTINGHOUSE TRACTION BRAKE CO.

GENERAL OFFICE AND WORKS, WILMERDING, PA.

NEW YORK ❦ ST. LOUIS ❦ PITTSBURGH ❦ WASHINGTON ❦ SAN FRANCISCO ❦ CHICAGO

VERSATILITY

TEC Equipment is pre-eminent for loading and unloading ships. If railroad track is not available at shipside, TEC trucks can haul big tonnages on distances under a mile at costs lower than by other methods. TEC Trucks eliminate distance between ship and railroad car or ship and warehouse.

Terminal Engineering Co.

17 Battery Place, New York, N. Y.

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STEEL BOXES AND SKID PLATFORMS

Shipments are handled with less labor and in quicker time where Truscon Steel Boxes, Skid Platforms and Trucks are used. They are furnished in types and sizes to meet every condition. Our engineers will give full information and useful suggestions.

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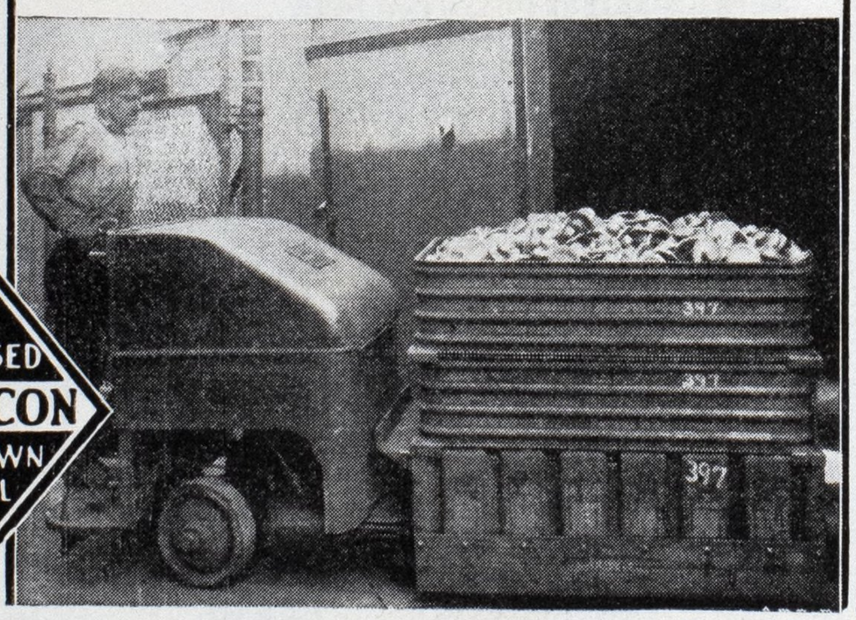
PRESSED STEEL DIVISION
6100 Truscon Ave. Cleveland, Ohio



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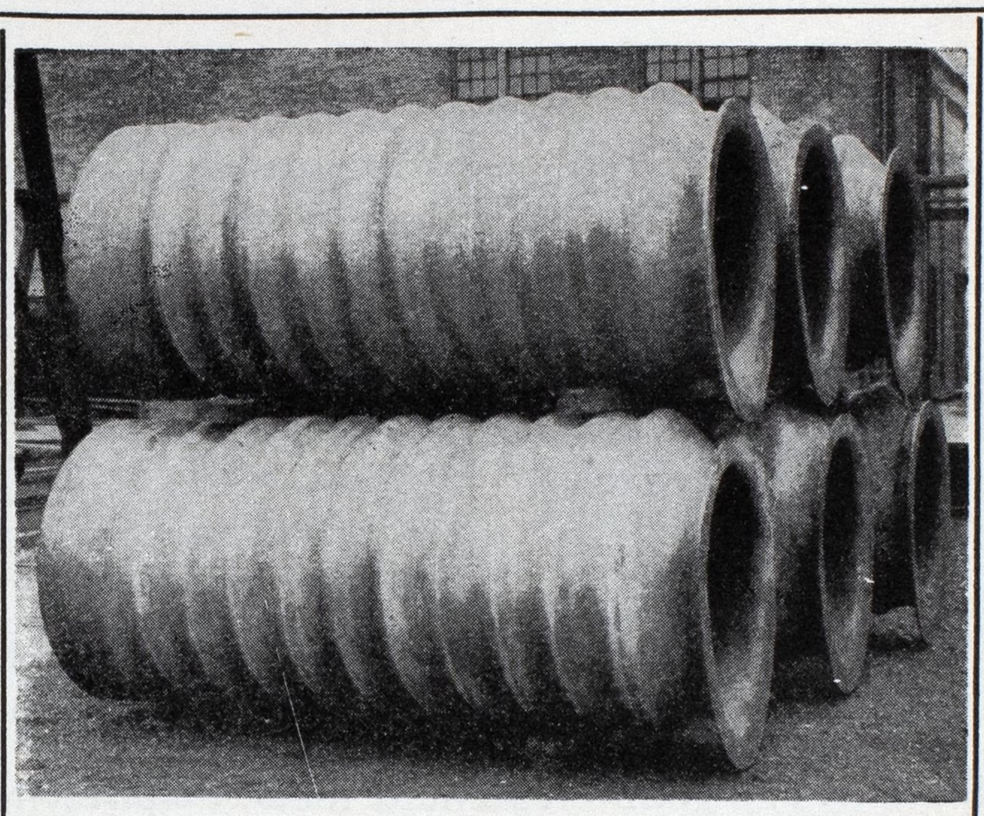

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The largest plant capacity in America with more than a thousand tons of firebox furnace plates in stock enables us to meet your demands for quick delivery. Continuous production for many years gives assurance of superior quality.

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Drydocking, Shipbuilding and Ship Repairs of All Kinds
The Most Modern Shops in Baltimore 2—9000 Ton Floating Drydocks
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DAY and NIGHT SERVICE
Plant Phones: Curtis 0500 - 0501 - 0502 - 0503

For the New AGWI Liners

BABCOCK & WILCOX Water-Tube Boilers, Superheaters, Oil Burners and No. 80 Fire Brick, for the new steamers of the Atlantic, Gulf & West Indies Steamship Lines, to operate at 300 pounds pressure and 200 degrees superheat, indicate not only the marked advance in recent years towards higher efficiency and economy in the operation of steam-driven vessels, but are the latest and best practice in the field of Naval Architecture and Marine Engineering.

THE BABCOCK & WILCOX CO.

Manufacturers of Marine Water-Tube Boilers Since 1895

SAN FRANCISCO **NEW YORK** **CLEVELAND**

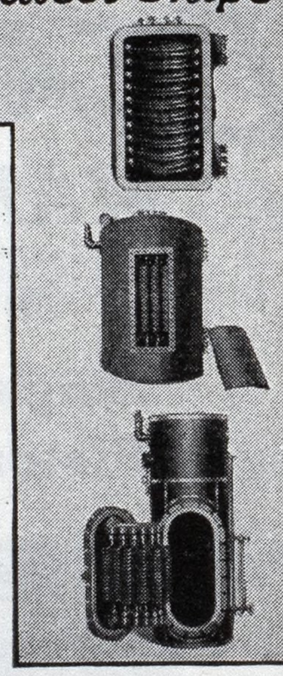
Standard on the World's Greatest Ships

Paracoil

MARINE EQUIPMENT

Operating for years without interruption on many of the largest ships afloat, Paracoil equipment is accepted as standard throughout the marine world.

Paracoil equipment includes the following: Feed Water Heaters, Oil Heaters, Oil Coolers, Feed Water Filters and Grease Extractors, Evaporators, Distillers, Steam Traps, Exhaust Gas, Steam or Hot Water Generators—for Diesel Plants, and Rand System for Heating Bunker Oil.



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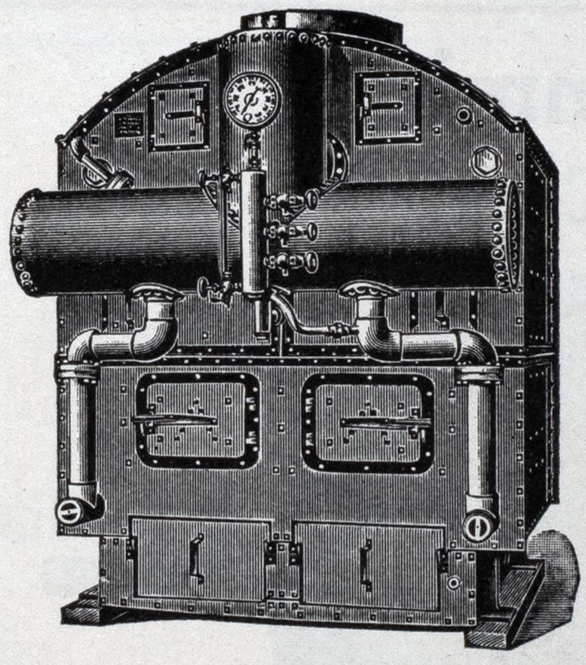

Almy Water Tube Boiler Co.

Builders of Sectional Water Tube Boilers for all types of vessels

Providence, R. I. U. S. A.

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Heat Transfer Apparatus

Reilly Heaters

For boiler feed and general service

Serving over 12,000,000 BHP

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(Scale-Shedding)

Bentube and Reilly Types

Serving over 10,000,000 BHP

Multiwhirl Coolers

For cooling oil to turbine bearings and reduction gears. For cooling Diesel engine jacket water.

Thousands in use.

THE GRISCOM-RUSSELL COMPANY, 285 Madison Ave., New York

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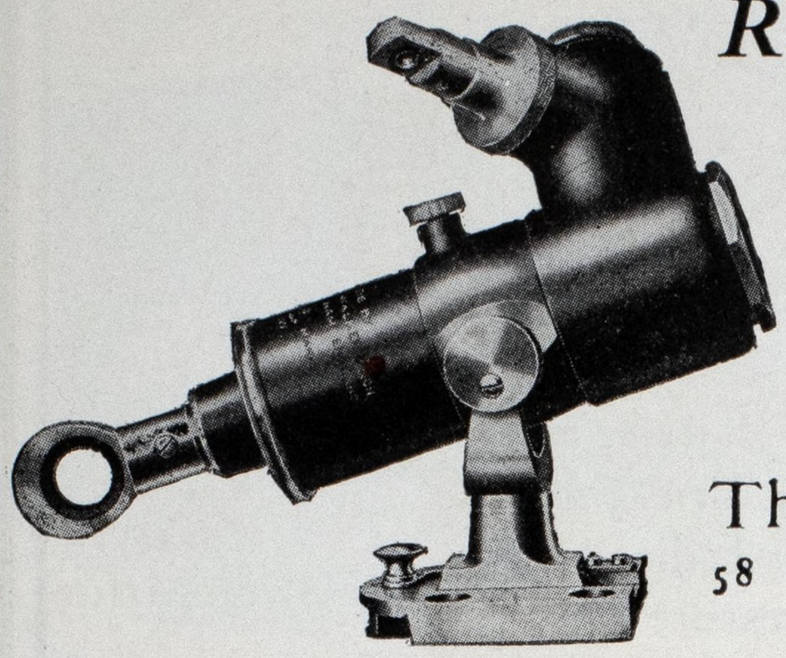
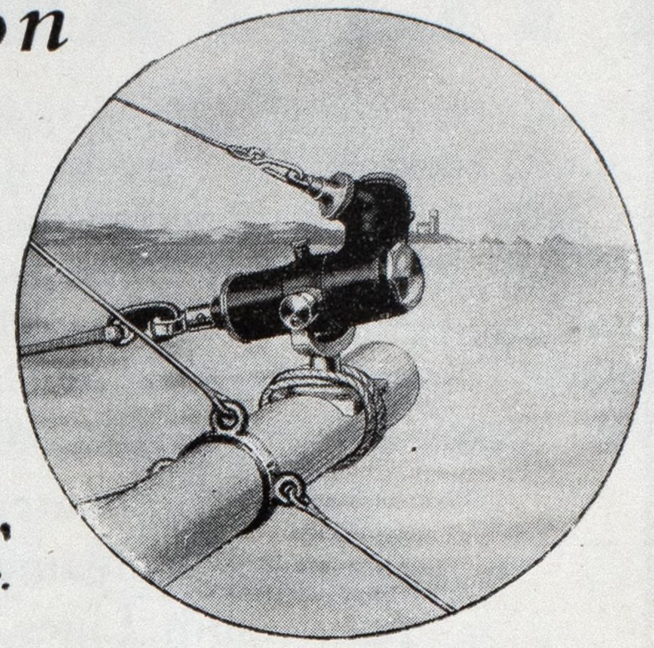


Read the Log on the Bridge!

Walker's "Viking" Ship-Log Connector can be set at any angle and therefore be fitted either ahead, abreast or abaft the Bridge. Mechanism is totally enclosed and with one filling of Walker's Special Solidified Oil will run the longest of sea passages without attention. Walker's Instruments are obtainable of all leading Nautical Instrument Dealers.



Thos. Walker & Son, Ltd.,

58 Oxford Street, Birmingham, Eng.

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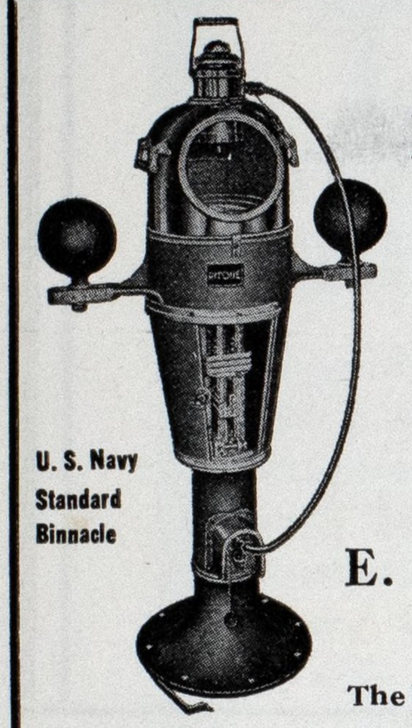

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Magnets for adjusting Purposes.

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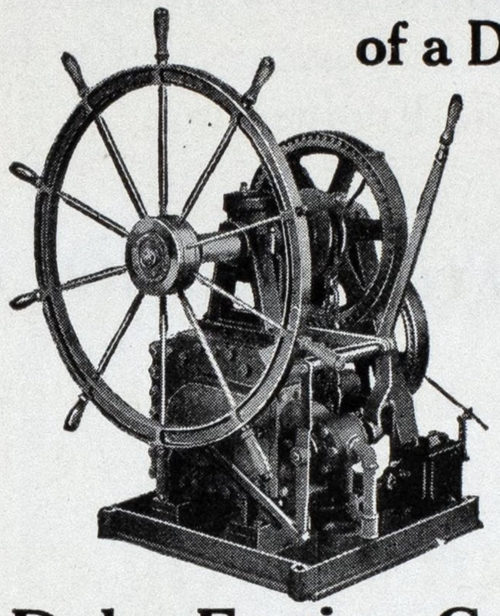
Brookline, Mass., U. S. A.

Agents for the Great Lakes,

The Upson-Walton Company, Cleveland, Ohio

The Strong, Quick Arm of a DAKE Steering Gear



on the tiller chain of your tug or steamer means greater efficiency, safety and economy.

The Dake Engine has no dead center; it is always alert, and starts instantly in either direction. This insures easier, quicker and better handling of your boat and saves time, coal and accidents.

The Dake fits into your pilot house and has a hand steering combination feature for emergency use.

Dependable gears at extremely moderate prices.

Ask any skipper who is shipmates with one

Dake Engine Co., Grand Haven, Mich.

Cummings

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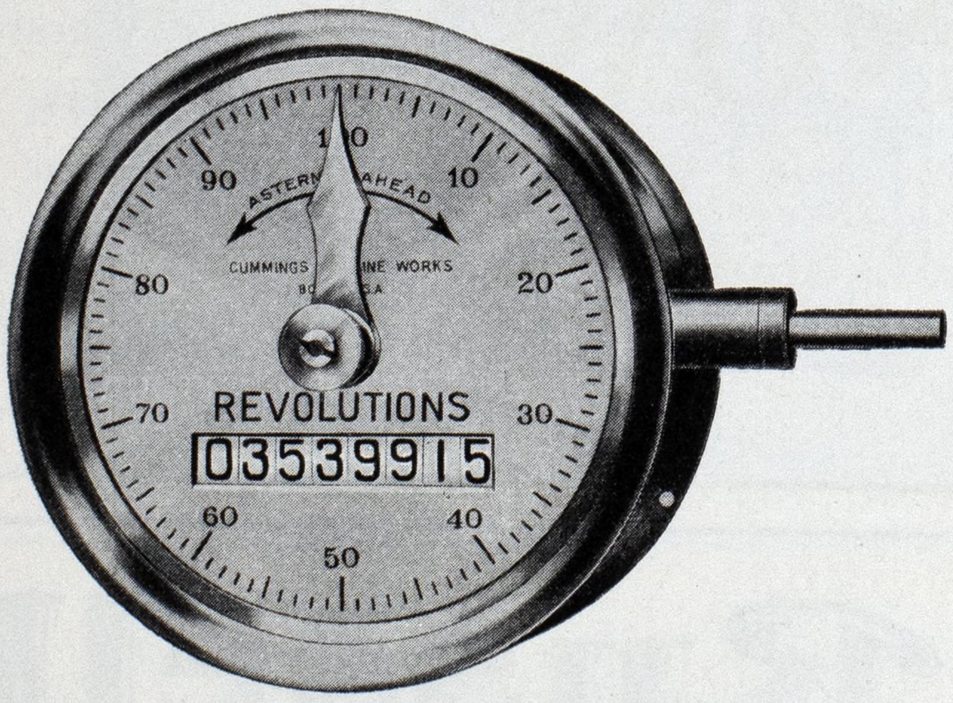


Adopted by the Panama Pacific Line on
S. S. California
S. S. Virginia
S. S. Pennsylvania

Cummings Revolution Counters and Gary-Cummings Torsion Meters

have been used on
U. S. Naval Vessels Since 1912

Cummings Machine Works

255 Atlantic Ave., Boston, Mass.

DEAN BROS.

MARINE PUMPS

"The Dean of Pumps on Land and Sea"

Single Style & Duplex
Piston Type & Plunger

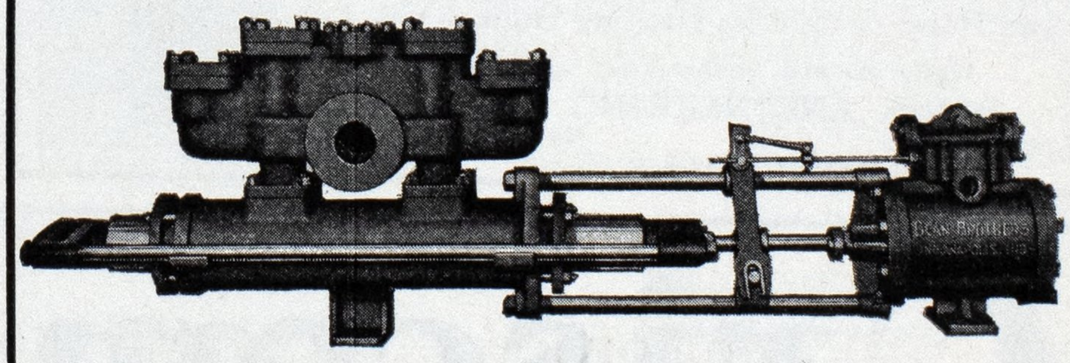


Figure No. 2311 Horizontal Single Style Double Acting Outside End Packed Plunger Trombone Pot Valve Pump For Boiler Feed & Pressure Service.

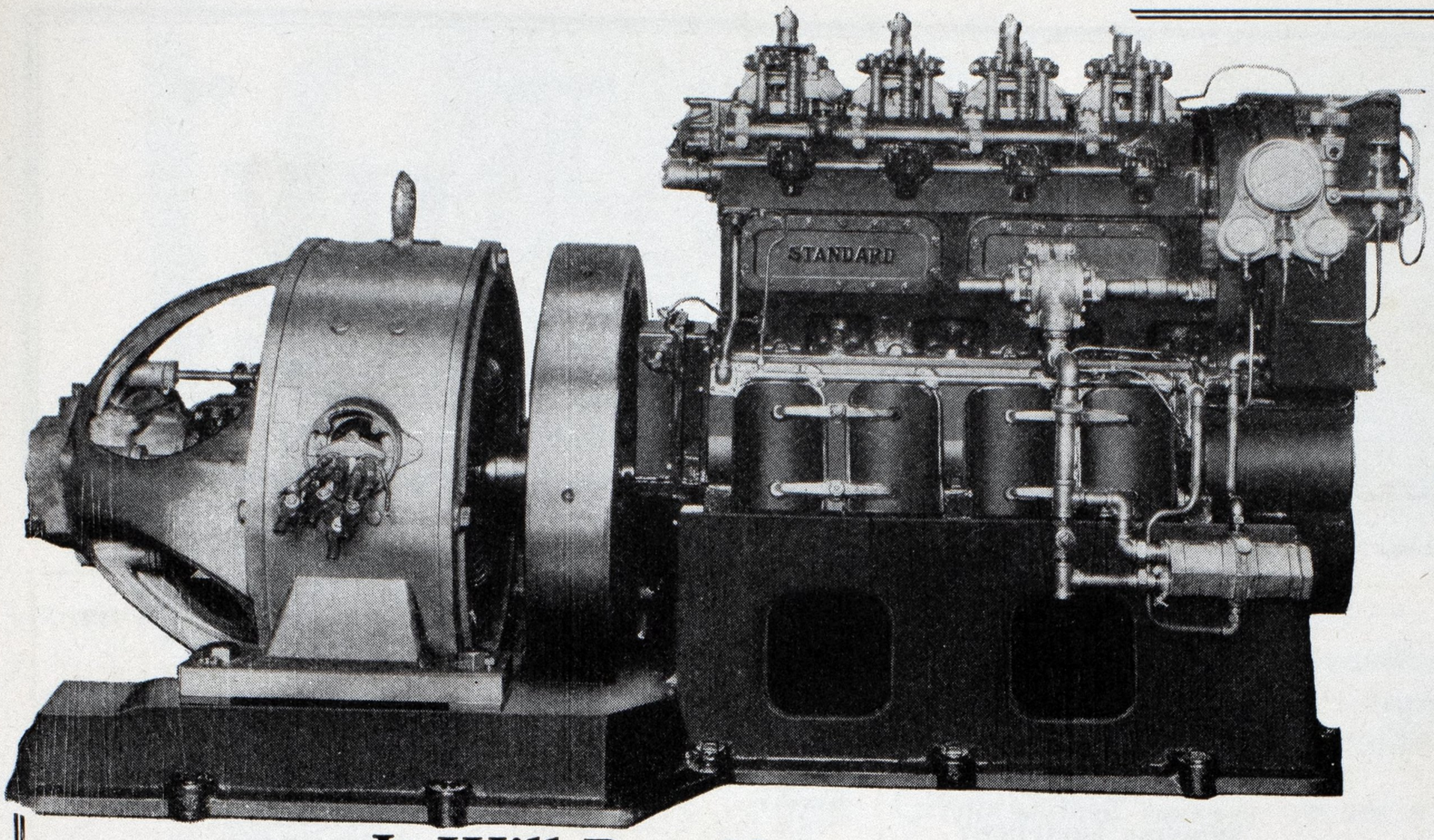
ESTABLISHED 1869

DEAN BROS. COMPANY

MANUFACTURERS OF PUMPING MACHINERY FOR ALL PURPOSES

323 WEST TENTH ST.

INDIANAPOLIS IND.



35 K. W. Diesel Generating Set For Gulf Refining Co.

It Will Pay You to get our quotations
on Diesel electric generating sets 20 to 300 K.W.
Also get our quotation on Propelling Engines 40-500 H.P.

STANDARD MOTOR CONSTRUCTION COMPANY
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A classified-by-products list of advertisers for the convenience of readers. If you don't find what you want, write us and we will tell you where to get it. ¶Index to advertisements will give you page number of any advertiser and by referring to advertisement you can get full particulars about products.

AIR COMPRESSORS—See COMPRESSORS

ARMOR (Submarine)
Morse, A. J., & Son, Inc.,
221 High St., Boston, Mass.

AVERAGING COUNTERS
Cummings Machine Works,
255 Atlantic Ave., Boston, Mass.

BABBITT METAL
Westinghouse Electric & Mfg. Co.,
East Pittsburgh, Pa.

BARGES
Federal Shipbuilding & Dry Dock Co., Lincoln Highway,
Kearney, N. J.

BARGES (Steel)
American Bridge Co., 71 Broadway, New York City.
Atlantic Ellis Channel System, Inc., 33 Rector St., New York City.
Newport News Shipbuilding & Dry Dock Co., 233 Broadway, New York City.

BATTERIES
Electric Storage Battery Co., The, 19th and Allegheny Sts., Philadelphia.
Willard Storage Battery Co., 246 E. 131st St., Cleveland, O.

BINNACLES
Ritchie, E. S., & Sons,
Brookline, Mass.

BLOWERS (Flue)
American Shipbuilding Co.,
Foot of W. 54th St., Cleveland, O.

BLOWERS (Motor Driven Ventilation)
Sturtevant, B. F., Co.,
Hyde Park, Boston, Mass.

BOATS (Steel and Wood)
Newport News Shipbuilding & Dry Dock Co., 233 Broadway, New York City.

BOILER CONNECTIONS (Forged Steel)
Federal Shipbuilding & Dry Dock Co., Lincoln Highway, Kearney, N. J.
Taylor Forge and Pipe Works, 1440 S. 49th St., Chicago, Ill.

BOILERS (Marine)
Almy Water Tube Boiler Co., 184 Allen St., Providence, R. I.
American Shipbuilding Co., Foot of W. 54th St., Cleveland, O.
Babcock & Wilcox Co., 85 Liberty St., New York City.
Bethlehem Shipbuilding Corp., Ltd., Bethlehem, Pa.
Great Lakes Engineering Works, River Rouge, Mich.
Newport News Shipbuilding & Dry Dock Co., 233 Broadway, New York City.
Oldman-Magee Boiler Works, Inc., 36-40 Illinois St., Buffalo, N. Y.
Sun Shipbuilding & Dry Dock Co., Chester, Pa.
Toledo Shipbuilding Co., Toledo, O.

BOILERS (Water Tube)
Almy Water Tube Boiler Co., 184 Allen St., Providence, R. I.
Babcock & Wilcox Co., The, 85 Liberty St., New York City.

BOOKS (Technical)
Penton Publishing Co., Cleveland, O.

BROKERS (Vessel)
Boland & Cornelius, Marine Trust Bldg., Buffalo, N. Y.
Farley, Edward P., & Co., Inc., 11 Broadway, New York City.

BUNKER FUEL OIL—See FUEL OIL

BURNERS (Oil)—See OIL BURNING EQUIPMENT

CABLES
Columbian Rope Co., Auburn, N. Y.
Whitlock Cordage Co., 46 South St., New York City.

CALKING COTTON
Stratford, Geo., Oakum Co., 165 Cornelison Ave., Jersey City, N. J.

CAPSTANS
Bethlehem Shipbuilding Corp., Ltd., Bethlehem, Pa.
Dake Engine Co., Grand Haven, Mich.
Hyde Windlass Co., Bath, Me.

CAR FLOATS
American Bridge Co., 71 Broadway, New York City.
Atlantic Ellis Channel System, Inc., 33 Rector St., New York City.

CASTINGS
Bethlehem Shipbuilding Corp., Ltd., Bethlehem, Pa.
Great Lakes Engineering Works, River Rouge, Mich.
Newport News Shipbuilding & Dry Dock Co., 233 Broadway, New York City.
Standard Motor Construction Co., 172 Whiton St., Jersey City, N. J.

CASTINGS (Iron)
Busch-Sulzer Bros.-Diesel Engine Co., 2nd and Utah Sts., St. Louis, Mo.

CHANNEL CONSTRUCTION (Steel)
Atlantic Ellis Channel System, Inc., 33 Rector St., New York City.

COMBINATION COUNTER AND TELLTALE
Cummings Machine Works, 255 Atlantic Ave., Boston, Mass.

COMPASSES
Ritchie, E. S., & Sons, Brookline, Mass.
Sperry Gyroscope Co., The, Brooklyn, N. Y.

COMPRESSORS
Ingersoll-Rand Co., 11 Broadway, New York City.

CONDENSERS
Dean Brothers Co., 323 W. 10th St., Indianapolis, Ind.
Great Lakes Engineering Works, River Rouge, Mich.
Westinghouse Electric & Mfg. Co., So. Philadelphia, Pa.

CONTRAPROPELLER
Collingwood Shipyards, Inc., Collingwood, Ont., Canada.

CONTRARUDDER
Collingwood Shipyards, Inc., Collingwood, Ont., Canada.

CORDAGE
Columbian Rope Co., Auburn, N. Y.
Samson Cordage Works, Boston, Mass.
Whitlock Cordage Co., 46 South St., New York City.

DAVITS
Welin Davit & Boat Corp., 3-5 Vernon Ave., Long Island City, N. Y.

DECKING COVERING
Selby, Battersby & Co., 810 Noble St., Philadelphia, Pa.

DIESEL ENGINES—See ENGINES (Diesel)

DIESEL FUEL OIL—See FUEL OIL

DISTILLING APPARATUS
Griscom-Russell Co., 285 Madison Ave., New York City.

DIVING APPARATUS
Morse, Andrew J., & Son, Inc., 221 High St., Boston, Mass.

DRAFT (Artificial and Mechanical for Boilers)
American Shipbuilding Co., Foot of W. 54th St., Cleveland.
Great Lakes Engineering Works, River Rouge, Mich.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

DREDGING MACHINERY
Great Lakes Engineering Works, River Rouge, Mich.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

DRINKING FOUNTAINS
Haydenville Co., The, Haydenville, Mass.

DRY DOCKS
American Shipbuilding Co., Foot of W. 54th St., Cleveland.
Bethlehem Shipbuilding Corp., Ltd., Bethlehem, Pa.
Federal Shipbuilding & Dry Dock Co., Lincoln Highway, Kearney, N. J.
Great Lakes Engineering Works, River Rouge, Mich.
Los Angeles Shipbuilding & Dry Dock Corp., San Pedro, Cal.
Manitowoc Ship Building Corp., Manitowoc, Wis.
Maryland Dry Dock Co., Baltimore, Md.
Newport News Shipbuilding & Dry Dock Co., 233 Broadway, New York City.
New York Shipbuilding Co., Camden, N. J.
Sun Shipbuilding & Dry Dock Co., Chester, Pa.
Todd Shipyards Corp., 25 Broadway, New York City.
Toledo Shipbuilding Co., Toledo, O.

DYNAMOS
Westinghouse Electric & Mfg. Co., So. Philadelphia, Pa.

ELEVATORS (Portable)

EJECTORS (Ash)
Great Lakes Engineering Works, River Rouge, Mich.
Westinghouse Electric & Mfg. Co., So. Philadelphia, Pa.

ENGINE SPEED INDICATORS
Sperry Gyroscope Co., The, Brooklyn, N. Y.

ENGINEERS (Marine, Mechanical and Consulting)
Canada Steamship Co., P. O. Box 2430, Montreal, Can.
Great Lakes Engineering Works, River Rouge, Mich.
Todd Shipyards Corp., 25 Broadway, New York City.
United Dry Docks, Inc., 11 Broadway, New York City.

ENGINES
Busch-Sulzer Bros.-Diesel Engine Co., 2nd and Utah Sts., St. Louis, Mo.
Cooper-Bessemer Corp., The, Grove City, Pa.
Fairbanks, Morse & Co., 900 South Wabash Ave., Chicago, Ill.
Federal Shipbuilding & Dry Dock Co., Lincoln Highway, Kearney, N. J.
Standard Motor Construction Co., 172 Whiton St., Jersey City, N. J.
Sun Shipbuilding & Dry Dock Co., Chester, Pa.

ENGINES (Diesel)
Busch-Sulzer Bros.-Diesel Engine Co., 2nd and Utah Sts., St. Louis, Mo.
Cooper-Bessemer Corp., The, Grove City, Pa.
Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago.
Standard Motor Construction Co., 172 Whiton St., Jersey City, N. J.
Sun Shipbuilding & Dry Dock Co., Chester, Pa.

ENGINES (Internal Combustion)
Busch-Sulzer Bros.-Diesel Engine Co., 2nd and Utah Sts., St. Louis, Mo.
Cooper-Bessemer Corp., The, Grove City, Pa.
Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago.
Standard Motor Construction Co., 172 Whiton St., Jersey City, N. J.

ENGINES (Marine)
American Shipbuilding Co., Foot of W. 54th St., Cleveland.
Bethlehem Shipbuilding Corp., Bethlehem, Pa.
Busch-Sulzer Bros.-Diesel Engine Co., 2nd and Utah Sts., St. Louis, Mo.
Canada Steamship Lines, P. O. Box 2430, Montreal, Can.
Cooper-Bessemer Corp., The, Grove City, Pa.
Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago.
Ingersoll-Rand Co., 11 Broadway, New York City.
Newport News Shipbuilding & Dry Dock Co., 233 Broadway, New York City.
New York Shipbuilding Co., Camden, N. J.
Sturtevant, B. F., Co., Inc., Hyde Park, Boston, Mass.

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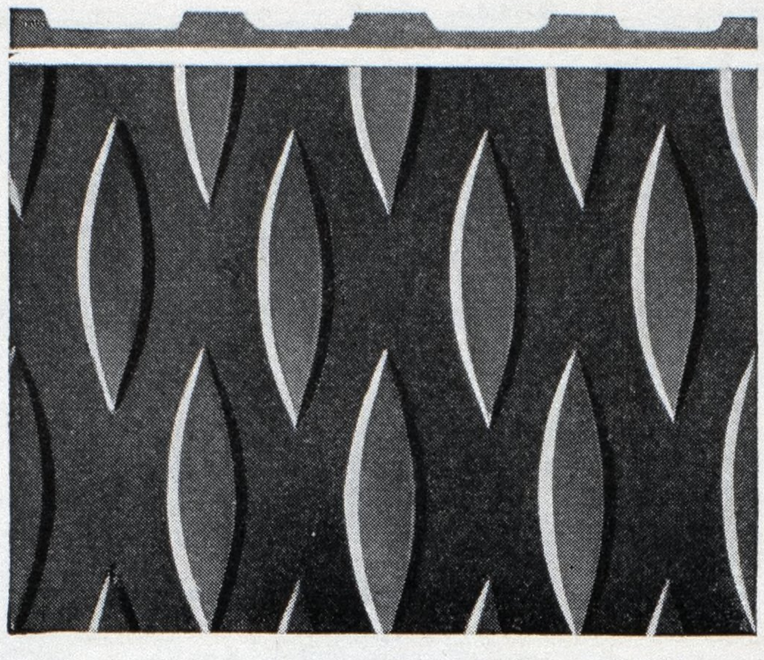
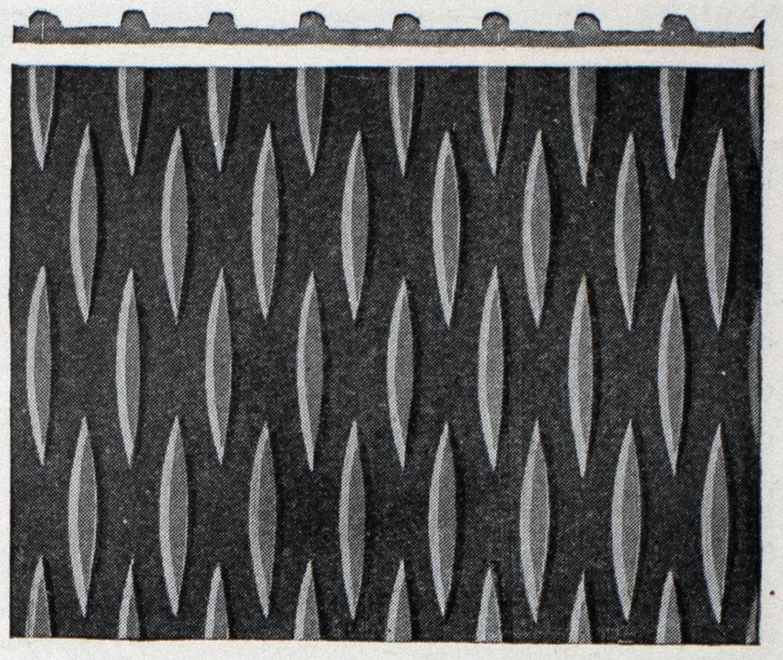


STANDARD "A.W." DIAMOND PATTERN
(one-half size)



"A.W." DIAMONDETTE PATTERN
(one-half size)

IT HASN'T THIS DISTINCTIVE PATTERN—
composed of carefully-spaced and properly-proportioned diamonds, oval in shape and raised from the surface of the plate, with the beveled edges of each diamond tapering off flush with the plate on all sides—

THEN IT ISN'T THE GENUINE

"A.W." Diamond Pattern Rolled Steel Floor Plate

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*Sheared Steel Plates
*Blue Annealed Sheets
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*"A.W." Traffic Treads
*Copper-Bearing, Alloy and Carbon Analyses

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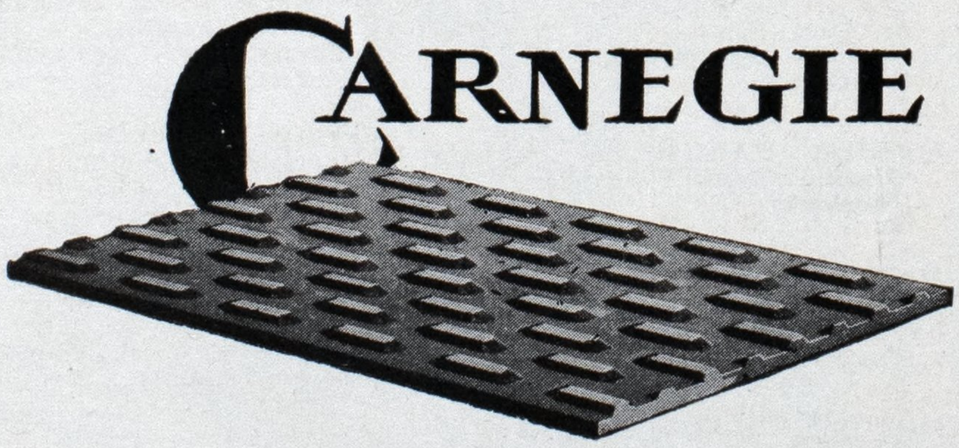
WERE SUPPLIED TO THE
BYRD ANTARCTIC EXPEDITION

KNOWN THE WORLD OVER — LANE — OLDEST IN THE U.S.A.

C. M. Lane Lifeboat Co., Inc.
Brooklyn, N. Y.

CARNEGIE FLOOR PLATE



Section M-41
Thickness—3/16" to 3/4" exclusive of raised figure.
Width —6" to 66".
Weight —8.8 to 31.7 pounds per square foot.
Recommended for floors, sidewalk openings, stair and traffic treads, where a safe, secure foothold is required. This design drains and cleans easily.

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ENGINES (Marine)—Continued
Sun Shipbuilding & Dry Dock Co., Chester, Pa.
Todd Shipyards Corp., 25 Broadway, New York City.
Toledo Shipbuilding Co., Toledo, O.
United Dry Docks, Inc., 11 Broadway, New York City.

ENGINES (Oil)
Busch-Sulzer Bros.-Diesel Engine Co., 2nd and Utah Sts., St. Louis, Mo.
Cooper-Bessemer Corp., The, Grove City, Pa.
Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago.
Ingersoll-Rand Co., 11Broadway, New York City.
Standard Motor Construction Co., 172 Whiton St., Jersey City, N. J.
Sun Shipbuilding & Dry Dock Co., Chester, Pa.

ENGINES (Reciprocating)
Hooven, Owens, Rentschler Co., The, Hamilton, Ohio.

ENGINES (Steam, Steering)
Dake Engine Co., Grand Haven, Mich.

EUROPEAN STEAMSHIP LINES (Passenger and Freight)
Hamburg-American Line 39 Broadway, New York City.

EVAPORATORS
Griscom-Russell Co., 285 Madison Ave., New York City.

FANS (Electric)
General Electric Co., Schenectady, N. Y.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

FEED WATER HEATERS—See HEATERS AND PURIFIERS (Feed Water)

FEED WATER REGULATORS
Babcock & Wilcox Co., 85 Liberty St., New York City.

FLANGES (Forged Steel Pipe)
Taylor Forge and Pipe Works, 1440 S. 49th St., Chicago, Ill.

FLOORING
Selby, Battersby & Co., 810 Noble St., Philadelpiha, Pa.

FLOOR PLATES
Carnegie Steel Co., Carnegie Bldg., Pittsburgh, Pa.

FOUNDERS
American Shipbuilding Co., Foot of W. 54th St., Cleveland, O.
New York Shipbuilding Co., Camden, N. J.

FOUNTAINS (Drinking)
Haydenville Co., The, Haydenville, Mass.

FREIGHT SERVICE
Hamburg-American Line, 39 Broadway, New York City.

FUEL OIL
Texas Co., The, 17 Battery Place, New York City
Vacuum Oil Co., 61 Broadway, New York City.

FURNACES (Corrugated Boiler)
Taylor Forge and Pipe Works, 1440 S. 49th St., Chicago, Ill.

FURNITURE
Marble & Shattuck Chair Co., 10200 Foster Ave., Cleveland, O.

GALLEY RANGES
Stamford Foundry Co., Stamford, Conn.

GAS (Acetylene Dissolved)
Prest-O-Lite Co., Inc., 30 East 42nd St., New York City.

GAS (Nitrogen and Oxygen)
Linde Air Products Co., 30 East 42nd St., New York City.

GAS (Welding and Cutting)
Prest-O-Lite Co., Inc., 30 East 42nd St., New York City.

GEARS (Marine Equipment)
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., So. Philadelphia, Pa.

GENERATING SETS
Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago.

GENERATING SETS (Direct Connected)
General Electric Co., Schenectady, N. Y.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., So. Philadelphia, Pa.

GENERATORS
Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

GRAPHITE
Dixon, Jos., Crucible Co., Jersey City, N. J.

GRAPHITE GREASES
Dixon, Jos., Crucible Co., Jersey City, N. J.

GRAPHITE PAINT
Dixon, Jos., Crucible Co., Jersey City, N. J.

GRAPHITE PIPE JOINT COMPOUNDS
Dixon, Jos., Crucible Co., Jersey City, N. J.

GREASE
Texas Co., The, 17 Battery Place, New York City.
Vacuum Oil Co., 61 Broadway, New York City.

GREASE (Launching)
Texas Co., The, 17 Battery Place, New York City.
Vacuum Oil Co., 61 Broadway, New York City.

GYRO-PILOT (Automatic Steering)
Sperry Gyroscope Co., The, Brooklyn, N. Y.

HARDWARE (Marine)—See MARINE HARDWARE

HATCH FASTENERS
Mullholland Hatch-Fastener Co., Marion Bldg., Cleveland, O.

HAWSERS (Manila)
Columbian Rope Co., Auburn, N. Y.
Samson Cordage Works, Boston.
Whitlock Cordage Co., 46 South St., New York City.

HEATERS AND PURIFIERS (Feed Water)
Davis Engineering Co., 90 West St., New York City.
Griscom-Russell Co., 285 Madison Ave., New York City.
Westinghouse Electric & Mfg. Co., So. Philadelphia, Pa.

HEATING EQUIPMENT
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

HEATING STOVES
Stamford Foundry Co., Stamford, Conn.

HOISTING ENGINES
Hyde Windlass Co., Bath, Me.

HOISTS (Air)
American Shipbuilding Co., Foot of W. 54th St., Cleveland.

HULLS (Steel)
Atlantic Ellis Channel System, Inc., 33 Rector St., New York City.

INDICATORS (Direction & Revolution)
Sperry Gyroscope Co., The, Brooklyn, N. Y.

INDICATORS (Helm Angle)
Sperry Gyroscope Co., The, Brooklyn, N. Y.

INDICATORS (Speed)
Sperry Gyroscope Co., The, Brooklyn, N. Y.

ICE MACHINES—See REFRIGERATING MACHINERY

INSURANCE (Marine)
Boland & Cornelius, Marine Trust Bldg., Buffalo, N. Y.

LAMPS (Mazda and Arc)
General Electric Co., Schenectady, N. Y.

LIFEBOATS
Lane, C. M., Lifeboat Co., Inc., 856 Humboldt St., Brooklyn, N. Y.
Welin Davit & Boat Corp., 3-5 Vernon Ave., Long Island City, N. Y.

LIFESAVING EQUIPMENT
Lane, C. M., Lifeboat Co., Inc., 856 Humboldt St., Brooklyn, N. Y.

LIGHTING EQUIPMENT
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

LOGS (Patent)
Walker, Thomas, & Son, Ltd., 58 Oxford St., Birmingham, England.

LUBRICATING OIL
Texas Co., The, 17 Battery Place, New York City.
Vacuum Oil Co., 61 Broadway, New York City.

MACHINERY (Marine)
American Shipbuilding Co., Foot of W. 54th St., Cleveland, O.
Bethlehem Shipbuilding Corp., Ltd., Bethlehem, Pa.
Cooper-Bessemer Corp., The, Grove City, Pa.
Great Lakes Engineering Works, River Rouge, Mich.
Los Angeles Shipbuilding & Dry Dock Corp., San Pedro, Cal.
Manitowoc Ship Building Corp., Manitowoc, Wis.
Maryland Dry Dock Co., Baltimore Md.
Toledo Shipbuilding Co., Toledo, O.

MACHINISTS
American Shipbuilding Co., Foot of W. 54th St., Cleveland, O.
Busch-Sulzer Bros.-Diesel Engine Co., 2nd & Utah Sts., St. Louis, Mo.
Federal Shipbuilding & Dry Dock Co., Lincoln Highway, Kearney, N. J.
New York Shipbuilding Co., Camden, N. J.

MANILA OAKUM—See OAKUM (Marine, Rope, Packings, Plumbers)

MATERIAL HANDLING EQUIPMENT
Smith, Leathem D., Dock Co., Sturgeon Bay, Wis.

MOTOR GENERATOR SETS
Fairbanks, Morse & Co., 900 South Wabash Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MOTORS (Electric)
Fairbanks, Morse & Co., 900 Wabash Ave., Chicago.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MOTORS (Winch)
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

NAUTICAL INSTRUMENTS
Ritchie, E. S., & Sons, Brookline, Mass.
Sperry Gyroscope Co., The, Brooklyn, N. Y.

NAVIGATING INSTRUMENTS
White, Kelvin & Wilfrid O., Co., 112 State St., Boston. Mass.

NITROGEN (Gas)
Linde Air Products Co., 30 East 42nd St., New York City

OAKUM (Marine, Rope, Packings, Plumbers)
Stratford, George, Oakum Co., 165 Cornelison Ave., Jersey City, N. J.

OIL BURNING EQUIPMENT
Babcock & Wilcox Co., 85 Liberty St., New York City.
Bethlehem Shipbuilding Corp., Ltd., Bethlehem, Pa.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

OIL FOR ALL PURPOSES (Marine)
Texas Co., The, 17 Battery Place, New York City.
Vacuum Oil Co., 61 Broadway, New York City.

OXYGEN (Gas)
Linde Air Products Co., 30 East 42nd St., New York City.

PACKING RINGS
American Hammered Piston Ring Co., Baltimore, Md.

PASSENGER SERVICE
Hamburg-American Line, 39 Broadway, New York City.

PIPE (Iron and Steel)
Taylor Forge and Pipe Works, 1440 S. 49th St., Chicago, Ill.

PISTON RING MANUFACTURERS
American Hammered Piston Ring Co., Baltimore, Md.

PLATES (Sheared Steel)
Wood, Alan, Steel Co., Conshohocken, Pa.

PLATES (Steel Floor)
Wood, Alan, Steel Co., Conshohocken, Pa.

PLATFORMS (Skid)
Truscon Steel Co., Pressed Steel Div., Youngstown, Ohio.

PROPELLER BLADES AND HUBS
Sheriffs Mfg. Co., Milwaukee, Wis.

PROPELLER WHEELS
American Shipbuilding Co., Foot of W. 54th St., Cleveland, O.
Great Lakes Engineering Works, River Rouge, Mich.
Newport News Shipbuilding & Dry Dock Co., 233 Broadway, New York City.
Sheriffs Mfg. Co., Milwaukee, Wis.
Toledo Shipbuilding Co., Toledo, O.
Trout, H. G Co., 220 Ohio St., Buffalo, N. Y.

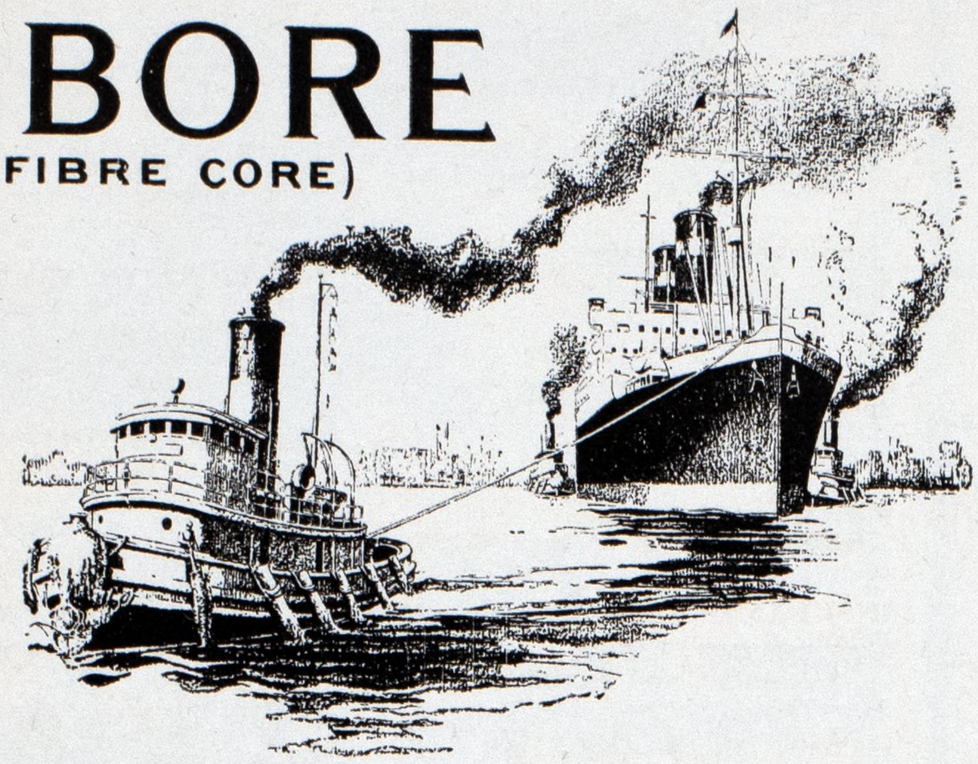
PROPELLERS
Bethlehem Shipbuilding Corp., Ltd., Bethlehem, Pa.
Hyde Windlass Co., Bath, Me.
Newport News Shipbuilding & Dry Dock Co., 233 Broadway, New York City.

PULVERIZED COAL BURNERS
Todd Shipyards Corp., 25 Broadway, New York City.

PUMPS
Bethlehem Shipbuilding Corp., Ltd., Bethlehem, Pa.
Dean Brothers Co., 323 W. 10th St., Indianapolis, Ind.
Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago.

See Index to Advertisements for Pages Containing Advertisements of Companies Listed Above

FIBORE
(FIBRE CORE)



The World's
Strongest,
Most Durable
Manila Rope

INCOMPARABLE!

WHITLOCK CORDAGE COMPANY

46 South Street
New York

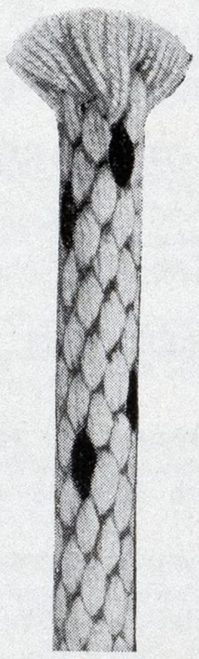
Factory and Warehouses
Jersey City, N. J.

Branches
Chicago, Boston, Kansas City
and Houston

SAMSON SPOT
Log Lines

Smooth, tough and durable; no adulterating material to stiffen it and decrease strength and durability. Solid braided of extra quality cotton yarn. Uniform in size and quality. Easily identified by the colored spots, our trade mark.

We also manufacture flag halyards, lead lines, tiller rope; solid braided cotton cord in all sizes for various marine uses. Ask for catalog and samples.



Trade Mark Reg. U.S. Pat. Off.

SAMSON CORDAGE WORKS

88 BROAD STREET BOSTON, MASS.

"Then Ho for the sea so damp and free"

Deep sea sailormen realize that in a well-caulked tight bottom lies not only the welfare of the vessel and the crew but the safe delivery of the cargo.

For a hundred years,

STRATFORD OAKUM

has been keeping the ocean out of the finest ships that sail. Sailors depend on Stratford Oakum because they know it is the best.

Stratford Oakum is most economical to use. Wastage is very small, less labor is required to spin and caulk and it "stays put," whether in deck, side or bottom.

Seams right-caulked with Stratford Oakum will stay tight longer than when any other material is used.

Be sure you get Stratford Oakum

George Stratford Oakum Company
Jersey City, New Jersey
Also Manufacturers of Cotton Wiping Waste

*5

PUMPS
Great Lakes Engineering Works, River Rouge, Mich.
Ingersoll-Rand Co., 11 Broadway, New York City.
Warren Steam Pump Co., Inc., Warren, Mass.

PUMPS (Ballast)
Dean Brothers Co., 323 W. 10th St., Indianapolis, Ind.
Warren Steam Pump Co., Inc., Warren, Mass.

PUMPS (Bilge)
Dean Brothers Co., 323 W. 10th St., Indianapolis, Ind.
Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago.
Warren Steam Pump Co., Inc., Warren, Mass.

PUMPS (Boiler Feed)
Dean Brothers Co., 323 W. 10th St., Indianapolis, Ind.
Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago.
Warren Steam Pump Co., Inc., Warren, Mass.

PUMPS (Direct Acting)
Dean Brothers Co., 323 W. 10th St., Indianapolis, Ind.

PUMPS (Power)
Dean Brothers Co., 323 W. 10th St., Indianapolis, Ind.
Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago.

PUMPS (Steam)
Dean Brothers Co., 323 W. 10th St., Indianapolis, Ind.
Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago.
Warren Steam Pump Co., Inc., Warren, Mass.

PUMPS (Vacuum)
Dean Brothers Co., 323 W. 10th St., Indianapolis, Ind.

PURIFICATION SYSTEMS—See WATER PURIFICATION SYSTEMS

RADIO COMPASS AND DIRECTION FINDER
Radiomarine Corp. of America, 66 Broad St., New York City.

RADIO EQUIPMENT
Radiomarine Corp. of America, 66 Broad St., New York City.

RAFTS
Lane, C. M., Lifeboat Co., Inc., 856 Humboldt St., Brooklyn, N. Y.

RANGES
Stamford Foundry Co., Stamford, Conn.

REPAIRS
Los Angeles Shipbuilding & Dry Dock Corp., San Pedro, Cal.
Maryland Dry Dock Co., Baltimore, Md.

REPAIRS (Electric)
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

REPAIRS (Marine)
American Shipbuilding Co., Foot of W. 54th St., Cleveland.
Bethlehem Shipbuilding Corp., Ltd., Bethlehem, Pa.
Canada Steamship Lines, P. O. 2435, Montreal, Can.
Chicago Shipbuilding Co., So. Chicago, Ill.
Collingwood Shipyards, Inc., Collingwood, Ont., Canada.
Federal Shipbuilding & Dry Dock Co., Lincoln Highway, Kearney, N. J.
Great Lakes Engineering Works, River Rouge, Mich.
Manitowoc Ship Building Corp., Manitowoc, Wis.
Newport News Shipbuilding & Dry Dock Co., 233 Broadway, New York City.
New York Shipbuilding Co., Camden, N. J.
Sun Shipbuilding & Dry Dock Co., Chester, Pa.
Todd Shipyards Corp., 25 Broadway, New York City.
Toledo Shipbuilding Co., Toledo, O.
United Dry Docks, Inc., 11 Broadway, New York City

REPAIRS (Marine Engine)
Collingwood Shipyards, Inc., Collingwood, Ont., Canada.

REPAIRS (Turbine)
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

REVOLUTION COUNTERS
Cummings Machine Works, 255 Atlantic Ave., Boston, Mass.
Sperry Gyroscope Co., Manhattan Bridge Plaza, Brooklyn, N. Y.

ROPE (Manila, Net, Sisal, and Other Hard Fiber Cordage)
Columbian Rope Co., Auburn, N. Y.
Samson Cordage Works, Boston.
Whitlock Cordage Co., 46 South St., New York City.

ROPE (Transmission)
Columbian Rope Co., Auburn, N. Y.

ROPE OAKUM
Stratford, George, Oakum Co., Jersey City, N. J.

RUBBER TILE
Selby, Battersby & Co., 810 Noble St., Philadelphia, Pa.

RUST PREVENTATIVE (Oil)
Texas Co., The, 17 Battery Place, New York City.
Vacuum Oil Co., 61 Broadway, New York City.

SAFETY VALVES (Marine)
Star Brass Mfg. Co., 53 Oliver St., Boston, Mass.

SCHOONERS (Auxiliary)
American Shipbuilding Co., Foot of W. 54th St., Cleveland.
Toledo Shipbuilding Co., Toledo, O.

SEARCHLIGHTS (High Intensity)
Sperry Gyroscope Co., The, Brooklyn, N. Y.

SEARCHLIGHTS (Incandescent and Arc)
General Electric Co., Schenectady, N. Y.
Sperry Gyroscope Co., The, Brooklyn, N. Y.

SELF UNLOADING EQUIPMENT
Smith, Leathem D., Dock Co., Sturgeon Bay, Wis.

SEPARATORS (Oil)
Babcock & Wilcox Co., 85 Liberty St., New York City.

SHEETS (Blue Annealed)
Wood, Alan, Steel Co., Conshohocken, Pa.

SHIPBUILDERS
American Shipbuilding Co., Foot of W. 54th St., Cleveland.
Bethlehem Shipbuilding Corp., Ltd., Bethlehem, Pa.
Canada Steamship Lines, P. O. Box 2430, Montreal, Can.
Collingwood Shipyards, Inc., Collingwood, Ont., Canada.
Federal Shipbuilding & Dry Dock Co., Lincoln Highway, Kearney, N. J.
Great Lakes Engineering Works, River Rouge, Mich.
Los Angeles Shipbuilding & Dry Dock Corp., San Pedro, Cal.
Manitowoc Ship Building Corp., Manitowoc, Wis.
Maryland Dry Dock Co., Baltimore, Md.
Newport News Shipbuilding & Dry Dock Co., 233 Broadway, New York City.
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Smith, Leathem D., Dock Co., Sturgeon Bay, Wis.
Sun Shipbuilding & Dry Dock Co., Chester, Pa.
Todd Shipyards Corp., 25 Broadway, New York City.
Toledo Shipbuilding Co., Toledo, O.
United Dry Docks, Inc., 11 Broadway, New York City.

SHIPBUILDING SYSTEMS
Isherwood, J. W., & Co., Ltd., 17 Battery Place, New York City.

SHIP CONSTRUCTION (Channel System)
Atlantic Ellis Channel System, Inc., 33 Rector St., New York City.

SHIP STABILIZERS
Sperry Gyroscope Co., The, Brooklyn, N. Y.

SKID PLATFORMS (Lift Truck)
Truscon Steel Co., Pressed Steel Div., Youngstown, O.

SPUN OAKUM
Stratford, George, Oakum Co., Jersey City, N. J.

STEAMSHIP LINES (Passenger and Freight)
Hamburg-American Lines, 39 Broadway, New York City.

STEAM GAGES
Star Brass Mfg. Co., 53 Oliver St., Boston, Mass.

STEAM TRAPS
Davis Engineering Co., 90 West St., New York City.

STEEL BARGES—See BARGES (Steel)

STEERING ENGINES
Hyde Windlass Co., Bath, Me.

STEERING GEARS
American Shipbuilding Co., Foot of W. 54th St., Cleveland.
Bethlehem Shipbuilding Corp., Ltd., Bethlehem, Pa.
Hyde Windlass Co., Bath, Me.

STORAGE BATTERIES—See BATTERIES

STOVES
Stamford Foundry Co., Stamford, Conn.

SWITCHBOARDS
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

TELEMOTORS
Hyde Windlass Co., Bath, Me.

TORSION METERS
Cummings Machine Works, 255 Atlantic Ave., Boston, Mass.

TOWING LINES
Columbian Rope Co., Auburn, N. Y.
Whitlock Cordage Co., 46 South St., New York City.

TRACTORS
Clark Tructractor Co., Battle Creek, Mich.
Terminal Engineering Corp., 17 Battery Place, New York City.

TRANSMISSION (Rope)—See ROPE (Transmission)

TREADS (Steel Stair & Ladder)
Wood, Alan, Steel Co., Conshohocken, Pa.

TRUCKS
Clark Tructractor Co., Battle Creek, Mich.
Lewis-Shepard Co., Watertown Sta., 125 Walnut St., Boston.

TRUCKS (Lift)
Lewis-Shepard Co., 125 Walnut St., Boston, Mass.
Terminal Engineering Corp., 17 Battery Place, New York City.

TURBINES (Electric)
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., So. Philadelphia, Pa.

TURBINES (Marine)
Bethlehem Shipbuilding Corp., Ltd., Bethlehem, Pa.
Federal Shipbuilding & Dry Dock Co., Lincoln Highway, Kearney, N. J.
Newport News Shipbuilding & Dry Dock Co., 233 Broadway, New York City.
Westinghouse Electric & Mfg. Co., So. Philadelphia, Pa.

TURBINES (Steam)
DeLaval Steam Turbine Co., Trenton, N. J.
Newport News Shipbuilding & Dry Dock Co., 233 Broadway, New York City.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., So. Philadelphia, Pa.

TWINE AND ROPE
Columbian Rope Co., Auburn, N. Y.
Samson Cordage Works, Boston.
Whitlock Cordage Co., 46 South St., New York City.

VALVE RINGS
American Hammered Piston Ring Co., Baltimore, Md.

VALVES AND FITTINGS
Bethlehem Shipbuilding Corp., Ltd., Bethlehem, Pa.

VENTILATING EQUIPMENT
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

WATER PURIFICATION SYSTEMS
Griscom-Russell Co., 285 Madison Ave., New York City.

WELDERS (Electric Arc)
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

WELDING AND CUTTING GAS
Prest-O-Lite Co., Inc., 30 East 42nd St., New York City.

WHISTLES
Star Brass Mfg. Co., 53 Oliver St., Boston, Mass.

WINCHES
Bethlehem Shipbuilding Corp., Ltd., Bethlehem, Pa.
Dake Engine Co., Grand Haven, Mich.
Hyde Windlass Co., Bath, Me.

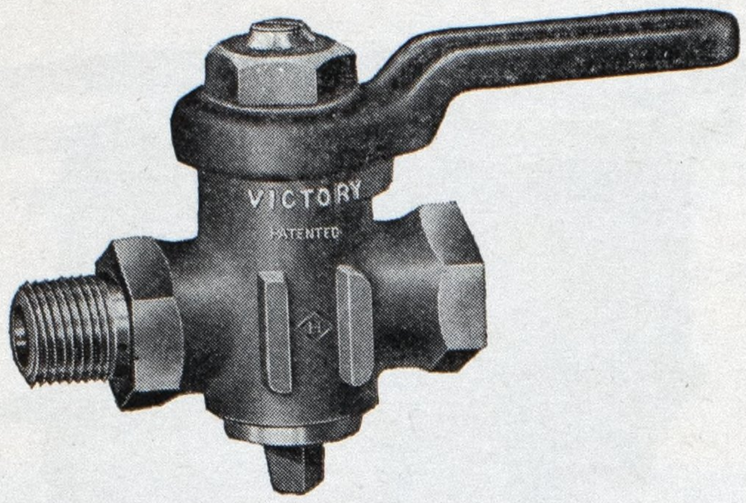
WINDLASSES
American Shipbuilding Co., Foot of W. 54th St., Cleveland.
Bethlehem Shipbuilding Corp., Ltd., Bethlehem, Pa.
Dake Engine Co., Grand Haven, Mich.
Hyde Windlass Co., Bath, Me.

WIRELESS MESSAGE SERVICE
Radiomarine Corp. of America, 66 Broad St., New York City.

WIRELESS SETS AND APPARATUS
Radiomarine Corp. of America, 66 Broad St., New York City.

WORKBOATS
Lane, C. M., Lifeboat Co., Inc., 856 Humboldt St., Brooklyn.

See Index to Advertisements for Pages Containing Advertisements of Companies Listed Above



VICTORY

LUBRICATED AIR COCKS

For Hard Service

in

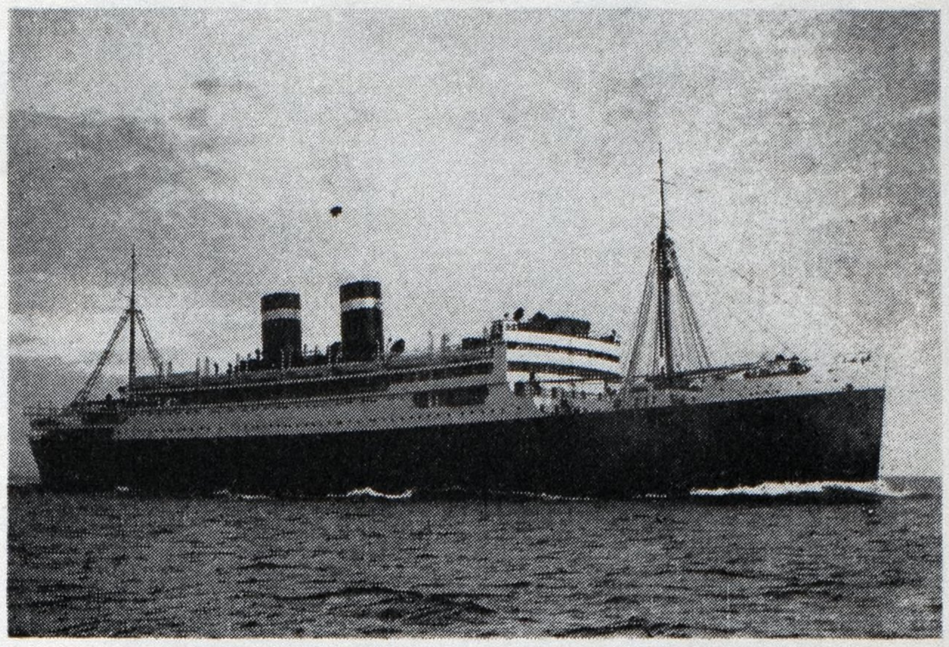
Shipyards and Foundries

Write for particulars

THE HAYDENVILLE CO.

Haydenville, Mass.

THE LARGEST



commercial vessel ever built in America, the **S. S. Pennsylvania**, will soon start her maiden voyage with **M & S** chairs on board, in luxuriously furnished quarters, for the comfort of her passengers.

Her sister ship, the **S. S. California** shown above, also uses chairs "*Designed for Comfort & Built to Last*".

Architects, Builders and Decorators "tune in" and use chairs on your vessel that express dignity and strength.

THE MARBLE & SHATTUCK CHAIR CO.

"Makers of Fine Chairs"

CLEVELAND, OHIO

New York, N. Y.—152 W. 42 St.—Tel. Wis. 2321

Leathem D. Smith Dock Co.

Sturgeon Bay, Wisconsin

Self-Unloading Boats our Specialty ***Self Propelled and Self Unloading River Boats***

Wood and Steel Repair Work

Remember!

SELBY, BATTERSBY & CO. FLOOR CRAFTERS PHILADELPHIA

SELBALITH

is the result of over fifteen years successful experience in laying over a million square feet of decking.

Write for free samples and quotations.

Selby, Battersby & Co.

Floorcrafters

810-12 Noble St. Phila., Pa.

ANDREW J. MORSE & SON, Inc.

221 High Street BOSTON, MASS.

Established 1837

Diving Apparatus and Submarine Armor
Fire Department Supplies
The Morse Monitor Nozzle
Callahan Shut-Off Nozzle

Star Brass Mfg. Co.

53 Oliver Street -::- Boston, Mass.

MANUFACTURERS OF

Accurate "Non-corrosive" Pressure and Recording Gages, Revolution Counters, Marine Clocks.

Dead Weight Gage Testers.

Marine Safety and Relief Valves for all pressures.

Marine Whistles and Sirens.

Extra Heavy Renewable Globe, Angle and Check Valves.

Star Outside Spring Steam Engine Indicators.

HIGH GRADE THROUGHOUT
SPECIFY AND ORDER THE BEST.

Branches: CHICAGO PITTSBURGH NEW YORK

Hamburg-American Line

Passenger Services: New York to Cherbourg, Southampton and Hamburg. New York to Galway, Cobh (Queenstown), Cherbourg and Hamburg.

Pleasure Cruises: Around the World, to the West Indies and to Northern Wonderlands.

Freight Services: New York to Hamburg Direct. Boston, Baltimore and Norfolk to Bremen and Hamburg. Philadelphia to Hamburg (Via New York). Also direct freight service from North Pacific Ports to Hamburg, Bremen and Antwerp.

Hamburg-American Line

39 Broadway New York

A Sure Way To Better Lubrication

and a substantial reduction in oil bills, is to use Dixon's Ticonderoga Flake Graphite.

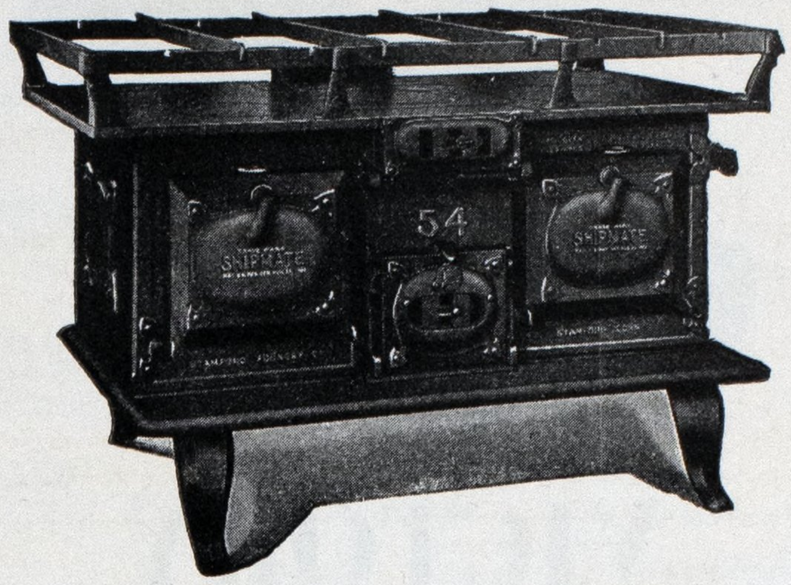
Dixon's Flake Graphite is the original lubricating graphite sold for decades in the red tins. It has outlived many competitors because it is a good product, carefully prepared and uniform in quality.

No doubt you are willing to learn more about it so write for Circular No. 81 C.

Joseph Dixon Crucible Company

Jersey City D X N TRADE MARK New Jersey

Established 1827



No. 54 SHIPMATE Range

If there is a range "as good as SHIPMATE", where is it?

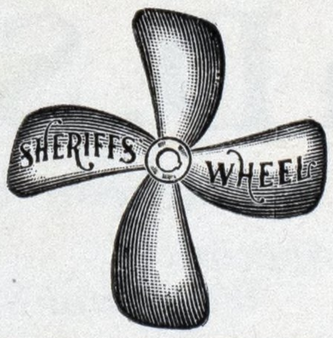
THE STAMFORD FOUNDRY COMPANY

Established 1830 Stamford, Conn.

The only SHIPMATE makers.

TROUT

BUFFALO U.S.A.



Propeller Wheels and Blades

to fit any hub.

Sheriffs Manufacturing Co.

Established 1854

Milwaukee, Wis.

THE MULHOLLAND HATCH-FASTENER COMPANY

Marion Building, Main 0272 **Cleveland, Ohio**

Manufacturers of the Mulholland Simplex and Security Hatch Fasteners.

For Ocean and Lake Trade

OVER 225,000 SETS NOW IN USE ON THE GREAT LAKES

Vessel and Insurance Agents

Kelvin & Wilfrid O. White Co.

112 State Street, Boston

Ship Compasses

Navigational Equipment

Contracts a Specialty

New York and Montreal

Edward P. Farley & Co.

Incorporated

Steamship Owners, Agents and Brokers

11 Broadway—New York

Oldman-Magee Boiler Works, Inc.

Boilers, Tanks, Stacks, Structural Work and Castings

Boiler Repairing Promptly Attended to Day or Night

MARINE WORK A SPECIALTY ELECTRIC WELDING

Works: 36-40 Illinois Street - BUFFALO, N. Y.

John J. Boland Adam E. Cornelius

BOLAND & CORNELIUS

VESSEL OWNERS AND BROKERS

Marine Insurance Agents

Marine Trust Building BUFFALO, N. Y.

Classified Advertisements

For Sale and Miscellaneous—Help and Positions Wanted

For Sale and Miscellaneous Advertisements
10c per word—minimum advertisement—$3.00

Six words must be added for box address.

To insure insertion, advertisements must reach us by the 10th of the month.

Help Wanted Advertisements
6c per word—minimum advertisement—$3.00

Position Wanted Advertisements
4c per word—minimum advertisement—$1.00

Please have remittance accompany order.

For Sale

SEABURY BOILER: WATER TUBE BOILER No. 495, built in 1924, used 3 months. Equipped with double oil burners using heavy oil.

Speedway Engine for the above boiler, 8½ x 14 x 23 x 12. Address Box 409, MARINE REVIEW, Cleveland, Ohio.

FOR SALE—STEEL TOW BARGE 227′ LONG BY 38′ BEAM BY 19′6″ DEEP. FOR ADDITIONAL DETAILS AND WHERE CAN BE INSPECTED WRITE BOX 411, MARINE REVIEW, CLEVELAND, OHIO.

FOR SALE: STEAMER GRANDON. LENGTH 64 ft. Beam 16 ft. For further particulars write The Post Fish Co., Sandusky, Ohio.

Position Wanted

SHIP DESIGNER AND CONSTRUCTOR with thirty years experience is open for a position. Prefer Great Lakes location. Address Box 412, MARINE REVIEW, Cleveland, Ohio.

For Sale

TUG MANOMET
FOR SALE
750 H.P.—New Boiler
The Central Dredging Co.
Chicago

FOR SALE
STEEL TOW BARGE
"SWEDEROPE"
227 ft. long, 38 ft. beam, 19′6″ deep
DETROIT SULPHITE TRANSPORTATION CO.
9125 W. JEFFERSON AVE.,
DETROIT, MICH.

FOR SALE
5000-Ton Bulk Carrier
Steamer Rockefeller
Toledo, Ohio
Recently rebuilt.
The Central Dredging Co.
Chicago, Ill.

For Sale

FOR SALE
COMPLETE COMPRESSOR INSTALLATION
1—9 x 8 ER-1 Compressor with Idler, unloader and lubricator.
1—30 H.P. G. E. Motor 3 phase, 60 cycle, 220 volt A.C., base, pulley and starter.
1—R-6 Receiver, 36″ x 8′, complete with all fittings.

PERFECT CONDITION.
REDWOOD LINE, INC.
1421 New Orleans Bank Bldg.,
New Orleans, La.

FOR SALE STEAM TUG SUITABLE FOR towing or fishing. 80 ft. long, 16½ ft. beam, 9 ft. draft. Three inch white oak plank, in best condition. 130 lbs. steam, 14½ by 16. Engine fully equipped. Boat in commission now. Box 413, MARINE REVIEW, Cleveland, Ohio.

Help Wanted

STEWARD WANTED FOR 85 FOOT YACHT. Home port Milwaukee. Season 1930 beginning April 15th. Must be good cook, cheerful, absolutely clean, good record, and have desire to please. Write Box 410, MARINE REVIEW, Cleveland, Ohio.

TO OUR SUBSCRIBERS

The classified section of **MARINE REVIEW** is for your convenience—its value is proving very worthwhile to everyone who uses it to buy and sell.

If you want to buy or sell ships or marine equipment—need a man for your organization—make it known to the entire marine industry through the use of classified advertising in **MARINE REVIEW.**

Mail copy for your advertisement in the January issue today, so it reaches us before December 20.

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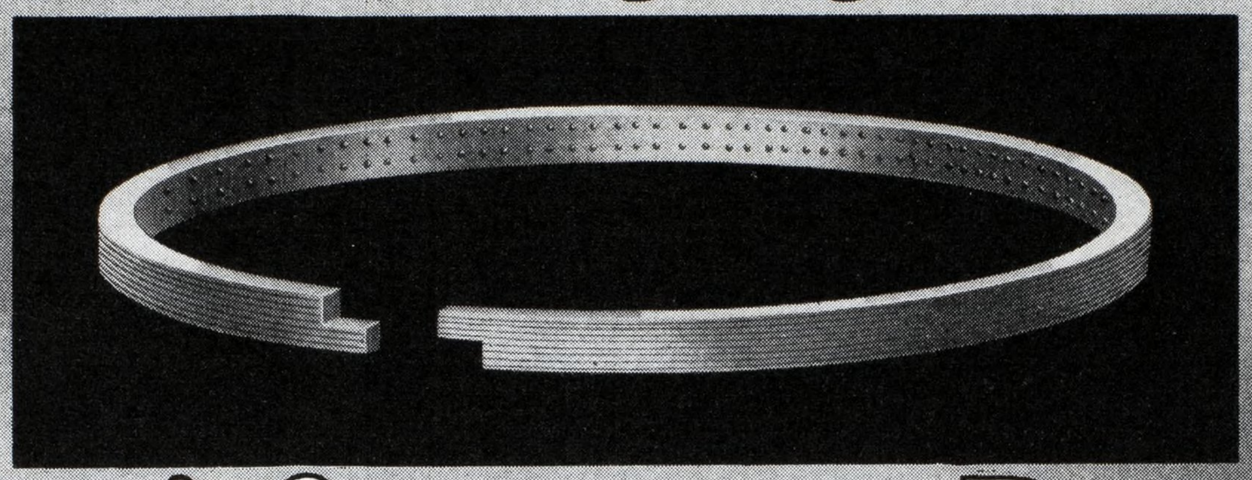
American Hammered Piston Rings

are used by

America's Leading Engine Builders



A Ring for every Purpose

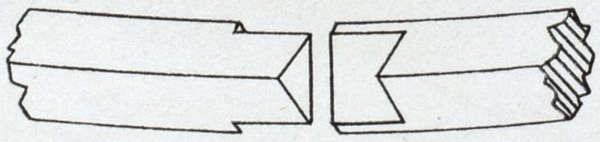
Cross Section of Special Rings Furnished When Required

Daros Duplex Ring

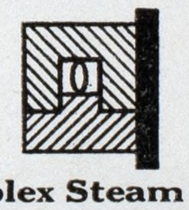
Cronin Inner Seal Ring

Two-Piece Seal Ring

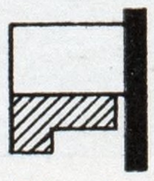
Three-Piece Compressor Ring



Step Seal Ring



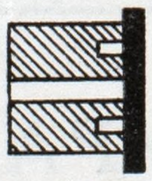
Duplex Steam Ring



Daros Wearing Ring
to Eliminate Groove Wear

Contracting Rings
Hammered on Outside Diameter

OIL RINGS



Ventilated

Scraper Drain

Bevelled and Grooved

For details write Engineering Department

The American Hammered Piston Ring Company

Baltimore, Maryland

Marine Branches

11 Moore Street, New York City

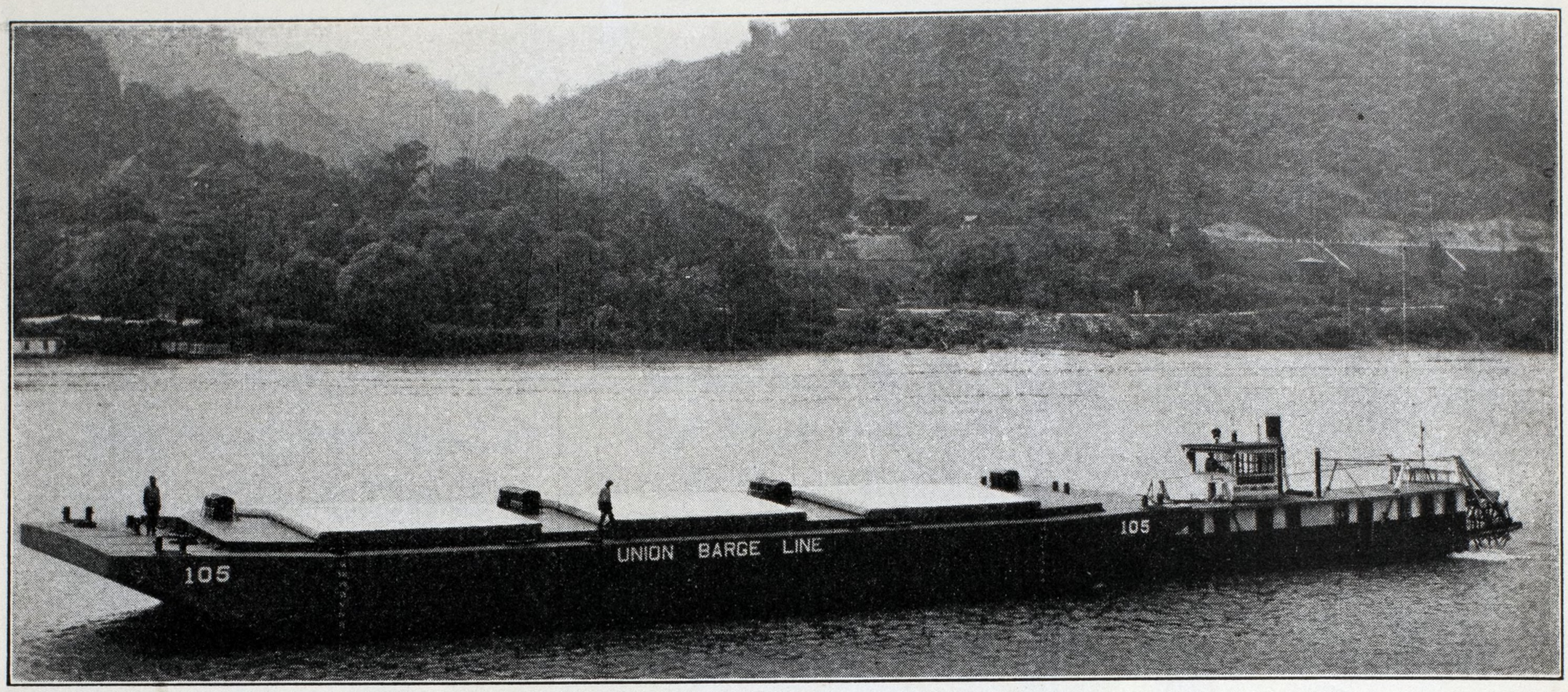
215 Market Street, San Francisco

501 Pico Street, Long Beach, California

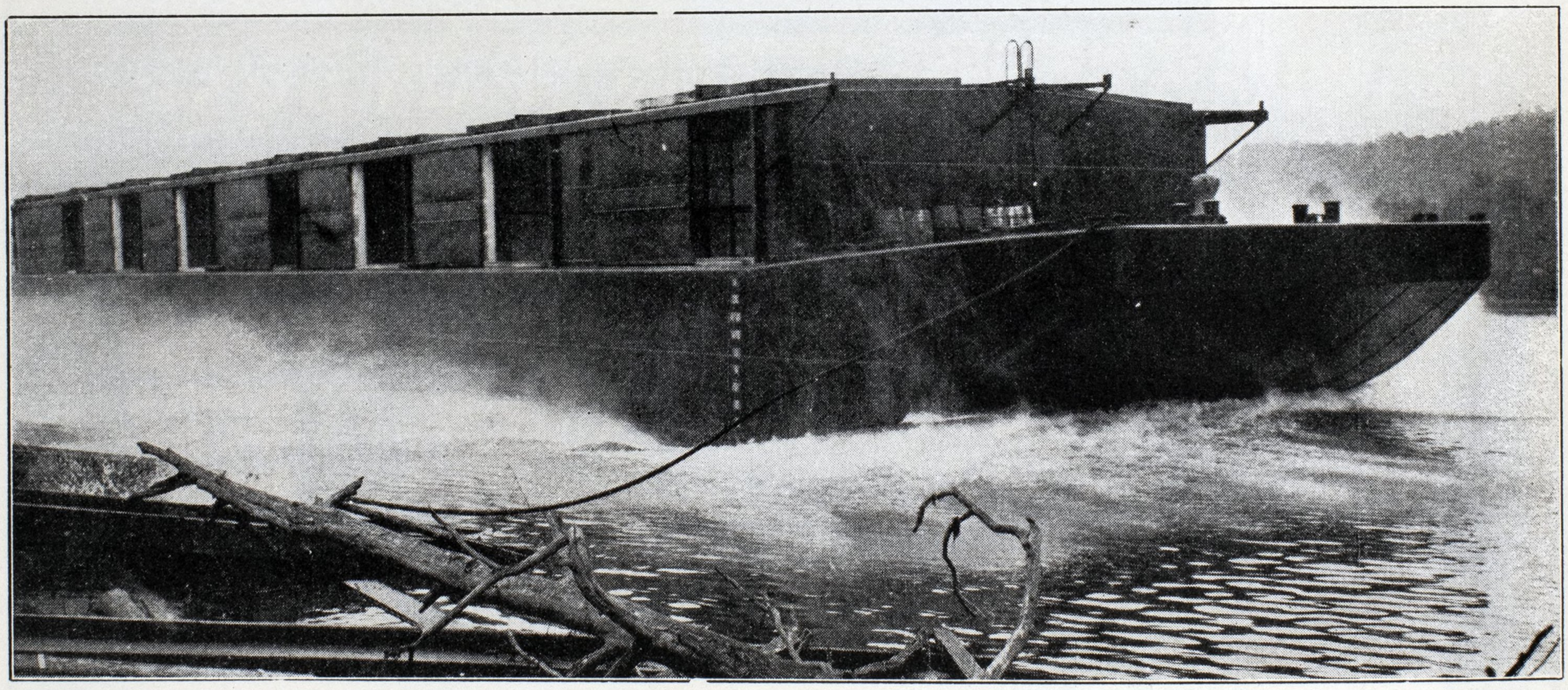
DESIGNERS and BUILDERS of

1903 STEEL BARGES 1929

For Twenty-six Years



Steel Barge (Covered) for Union Barge Line



Launching of Steel Barge for Inland Waterways, 1929

AMERICAN BRIDGE COMPANY

Subsidiary of United States Steel Corporation

MANUFACTURERS OF STEEL STRUCTURES

of all classes

BRIDGES — BUILDINGS — BARGES

Girders, Roof Trusses, Poles, etc.

Contracting Offices in principal cities

General Offices
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New York, N. Y.

Marine Department
Frick Building
Pittsburgh, Pa.

Busy Ships...

THE "OHIOAN" OF THE AMERICAN-HAWAIIAN STEAMSHIP COMPANY, IN DRYDOCK AT THE MORSE PLANT

BUSY ships have no time to waste. They must get into port and out again—on schedule. Time required for repairs must be held to the minimum.

Busy ships demand prompt efficient service—the sort of service that is standard at United's seven plants.

PROMPT EFFICIENT SERVICE

SEVEN PLANTS

Morse — Staten Island
Shewan — Alderton
Crane — Fletcher
New York Harbor

•••

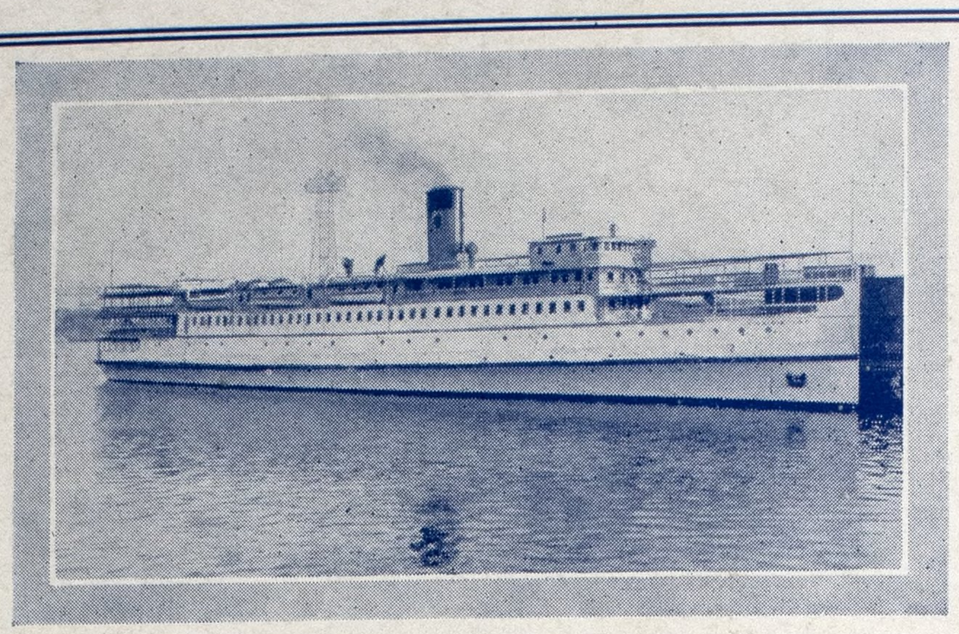
New York Harbor Plant reserved for drydocking and cleaning oil tankers

UNITED DRY DOCKS INC.

11 Broadway, New York

S. S. Virginia Lee of the Pennsylvania Railroad Co. Sturtevant Multivane Fans used for hull ventilation.

Photo—Courtesy Marine Review.



Sturtevant TRADE MARK

Sturtevant Multivane Fans Provide Ideal Ventilation

Comfort aboard ship for passengers and crew depend largely upon the efficiency of a ship's ventilating system. Fresh air in abundance must be available at all times.

The efficiency of Sturtevant Multivane Fans for ventilating purposes is proved by the many installations on ocean liners, government ships, and small coastwise boats.

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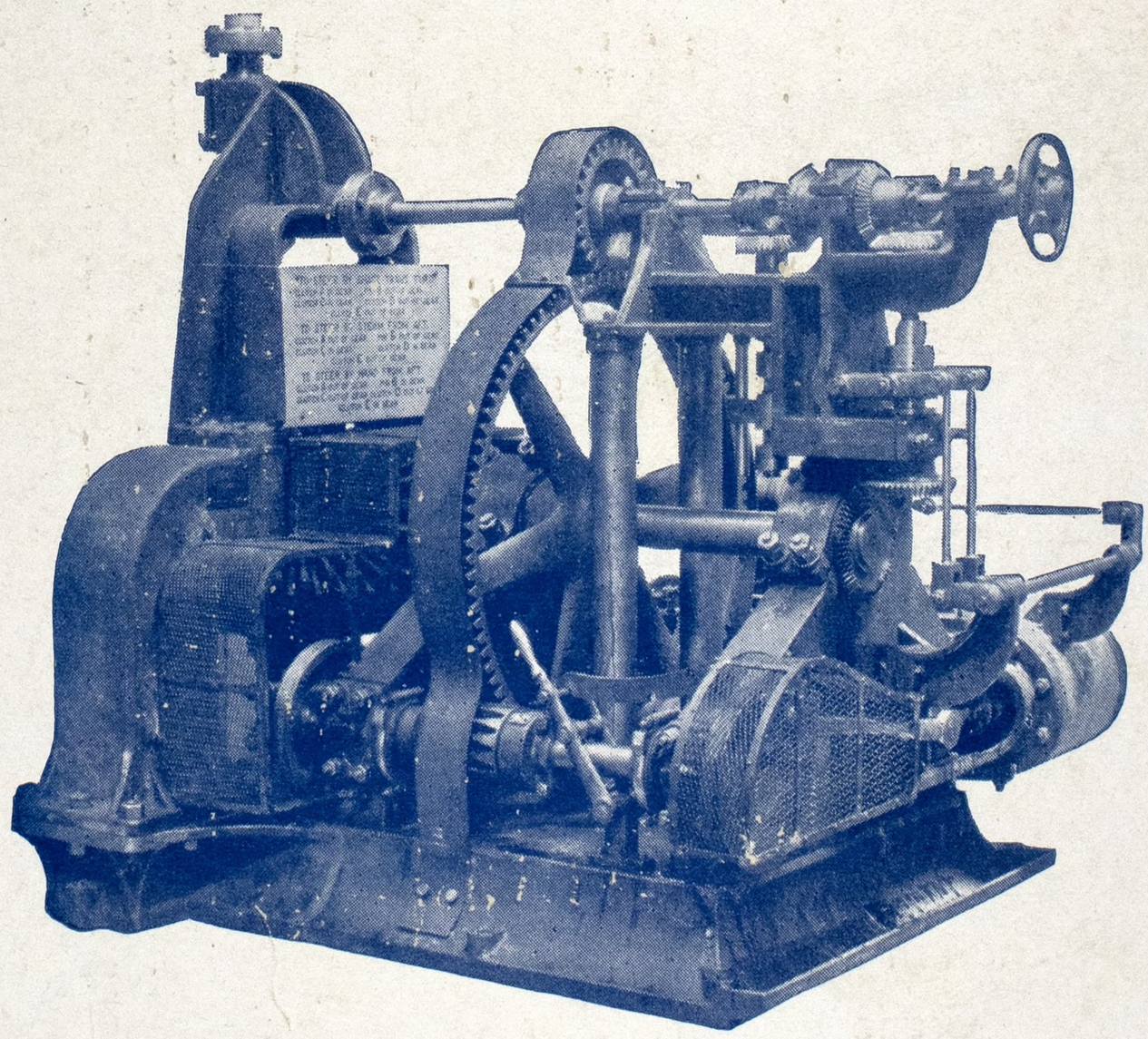

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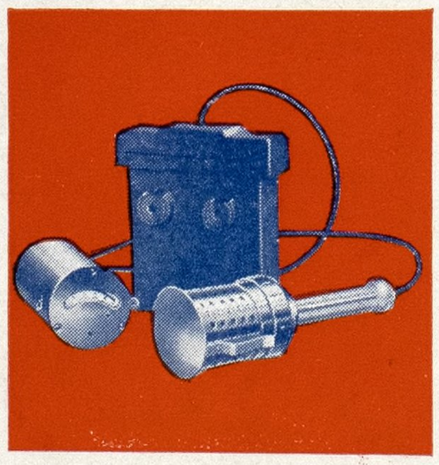

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